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A Complete Magazine On Sugar Industry

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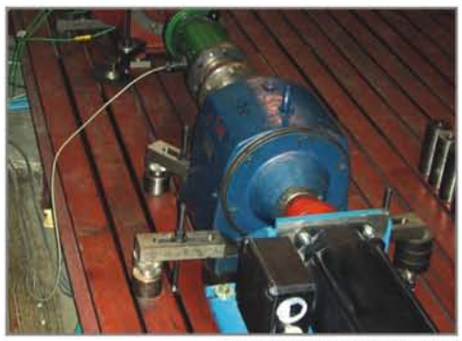

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VI SUGAR MILL

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- MR. G.H. TAMBE

- FACE TO FACE

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Having taken the views , suggestions and guidance of over 1400 qualified engineers from both end-user community of sugar industry and the manufacturing community of sugar industry, consisting of veteran technocrats Managing Directors, Chief Engineers, Chief Chemist, Project manager and Purchase Managers etc, and based on the guidance provided by these honorable technocrats we have STRUCTURED our magazine to make it a total knowledge enhancer.

We have engineered various sections of the magazine in order to make sure that each section is a COMPLETE KNOWLEDGE CAPSULE and provides PURE KNOWLEDGE to our community readers.

We are sure it will enhance the knowledge of plant engineers of sugar industry verticals were **ALL ABOUT SUGAR INDUSTRY Magazine** has its presence.

In this issue the technical papers titles "Adaptive Wavelet Transform Method to Identify Cracks in Gears" and "Performance enhancement for crystallization unit of a sugar plant using genetic algorithm technique" is a must read article for the plant engineers as it brings out few of the most critical insights about the subject matter and narrates how an pro-active step is to be taken and in what degree the calculated steps may result in to long term profit.

The Cover story in this issue spotlights MANDVI SUGAR Factory. The corporate cover story revels the energetic and enthusiastic management practices and floods light on various processes carried out in the plant to ensure quality at all levels.

Mr. G. D. Patil - Managing Director of Sahakari Khand Udyog Mandal Limited-Gandevi, and Mr. G.H.Tambe Managing Director - Maroli sugar factory are our LION LEADERS and shares few of the most critical insights about their personal and professional challenges and we can learn a lot from his experience.

FACE TO FACE section of the magazine covers the personal Interview with Mr. P. J. Mistry Chief Chemist Maroli Sugar factory and I am sure you will definitely like his tips to increase process efficiency.

IN FOCUS section of the magazine revels the insights of Chamunda Engineering Pvt. Ltd. The company owns the privilege to have delivered exceptional high quality services to some of the gem corporates of India. In addition the cover story will tell you why the company is one of the preferred choices in terms of critical applications.

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Govt to give more interest-free loan to sugar mills

New Delhi: The government decided to provide additional interest-free loan of up to Rs 4,400 crore to sugar mills and hike import duty on sweetener to enable the cash-starved industry pay their huge arrears to sugarcane farmers.

Import duty on sugar will be increased to 40 percent from 15 percent and export subsidy will be extended till September this year to give relief to the sugar industry, which owes Rs 11,000 crore to cane growers largely from Uttar Pradesh.

Efforts will be made to implement mandatory 5 percent ethanol blending with petrol and subsequently achieve 10 percent blending.

These decisions were taken at a high-level meeting called by Food Minister Ram Vilas Paswan, following Prime Minister's direction. Industry Body ISMA hailed the decision saying this will improve cash-flow of millers and help clear cane arrears.

Transport Minister Nitin Gadkari, MSME Minister Kalraj Mishra, Commerce Minister Nirmala Sitharaman, Women and Child Development Minister Maneka Gandhi, Petroleum Minister Dharmendra Pradhan, Principal Secretary to the PM Nripendra Misra and Cabinet Secretary Ajit Seth attended the meeting.

"We have taken four key decisions. We have decided to extend the interest-free loan given against excise duty paid by sugar mills for five years instead of three years," Paswan told reporters after the meeting. Mills can avail additional interest-free loans of up to Rs 4,400 crore from banks, he said, adding this will improve their cash flow to make cane payments.

However, the minister said the department is yet to calculate the exact interest-free loans to be provided to the industry against excise-duty.

In December, the Centre had approved Rs 6,600 crore interest-free loans for the sugar industry for clearing cane arrears. It decided to give loans via banks equivalent to the excise duty paid by the mills in the past three years.

These decisions will be subject to the mills giving guarantee that they will clear Rs 11,000 crore sugarcane arrears at the earliest, Paswan said.

"We don't have any problems to announce these incentives formally if millers are ready to make payments. If they give assurance today, we will announce incentives today itself", Paswan said. Some of the decisions will be notified by concerned ministries, while some require the Cabinet nod, he added.

Reacting to the decisions, Industry body ISMA Director General Abinash Verma said: "Out of Rs 6,600 crore claims for loans, about Rs 4,000 crore has been disbursed by banks so far based on the eligibility and the criteria set by the government".

"If this is taken into account, we expect Rs 2,500-3,000 crore loans may finally get disbursed out of the approximately Rs 4,400 crore claims that might come up," he said.

"With improvement in the sentiment because of these decisions taken by the government, we should be able to sell sugar and clear cane arrears soon, which is our top priority," Verma said.

Besides interest-free loan, Paswan said, "We have decided to increase the sugar import duty to 40 percent from the current 15 percent and extend the sugar export incentive of Rs 3,300 per tonne till September this year."

In order to encourage biofuel on the lines of Brazilian model, the government has decided to subsequently increase mandatory level of ethanol blending with petrol to 10 percent from the existing five per cent, he said.

"The Petroleum Minister has assured 10 percent ethanol blending with petrol," Paswan said.

It was in 2006 that the government launched the ethanol blending programme, which could not progress due to differences between sugar mills and oil companies over pricing.

Expressing concern over mounting cane arrears, Paswan said, "While the Centre fixes the cane price, some states are fixing higher prices that are putting burden on millers. There should be a holistic view on pricing."

The sugar industry has been facing a cash crunch due to higher cost of production and lower selling prices in the wake of surplus output over the past few years.

Currently, sugarcane arrears stand at about Rs 11,000 crore across the country, with the maximum of Rs 7,200 crore in Uttar Pradesh.

Mills are facing a cash crunch as domestic prices have slipped below the cost of production, hurting their profits. They also fear domestic prices could fall further if cheaper imports are not curbed.

Currently, sugar is being imported in smaller quantities. The decision to hike the import duty is expected to curb such shipments.

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To help sugar sector, talk of mixing ethanol with petrol

NEW DELHI: The government is once again trying to ride on the back of the auto sector to pull the sugar industry out of the slump, which has been induced by a bumper cane harvest.

Revival of sugar industries by pushing ethanol blending in petrol and releasing arrears of cane growers in Uttar Pradesh have become priorities for the Narendra Modi government. Two key BJP ministers from Maharashtra and three from Uttar Pradesh, both major sugar producers, are meeting food and consumer affairs minister Ram Vilas Paswan on Wednesday to tackle these issues.

The corridors of road transport and highways, heavy industries and food ministries were abuzz with talk of government's thrust on ethanol ever since road transport minister Nitin Gadkariasked his ministry to study whether auto companies can import E85 engines, used in countries such as Brazil and Canada, into India.

"I have spoken to Ram Vilas Paswan to involve the sugar industry and have also asked the petroleum ministry to be part of this," Gadkari, an MP from Nagpur, had said soon after taking charge. E85 engines use a mixture of 85% ethanol and 15% petrol.

During the UPA regime, Maharashtra strongman Sharad Pawar had also pushed for the use of ethanol but the move met with limited success. In any case, the clamour for the use of blended fuel died down soon after the sugar industry regained health.

Globally, the use of ethanol and corn for biofuels had triggered a huge debate over the use of farm produce for fuels. It was cited as one of the factors for driving up food and agri-commodity prices before the 2008 global financial crisis.

On Monday, Paswan said Gadkari, rural development minister Gopinath Munde and agriculture minister Radha Mohan Singh will attend the meeting. "We will get the views and concerns of the sugar industry and farmers as well since ministers including Kalraj Mishra, Maneka Gandhi and Sanjeev Balyan will also be present," he added.

Sources said sugar industry representatives have already met Paswan and have shared their views on revival of the sector.

Meanwhile, there are inputs of the road transport ministry and Automotive Research Association of India (ARAI) fast-tracking the plan to come out with a code for vehicles using ethanol blended petrol.

Food ministry officials said since the mandatory blending of 5% ethanol was not being adhered to, the sugar industry may demand that they get petrol. The industry has suggested that it can undertake blending and should be allowed to sell petrol at lower rate.

According to government estimates, about 105 crore litres of ethanol is required for the mandatory 5% blending. So far, only 30 crore litres have been procured.

Pushing for more ethanol blending is being seen as a move to keep the BJP's poll promise "to avoid over-dependence on any fuel and ensure supplier diversity, to avoid reliance on one supplier, country and developing indigenous capabilities to meet emerging needs."

Belize sugar to face competition from sugar beet in 2017: CEO Alpuche

Since the Belize Sugar Industries (BSI) / American Sugar Refining (ASR) and representatives of the local sugar cane farmers met more than 2 months ago, on March 28, to continue negotiations on a quantum payment for bagasse, there has been a lull in bagasse talks that is, until this Friday, June 6, when both parties, along with the Sugar Industry Control Board, acting as mediator, should resume consultations.

According to Alfredo Ortega, Vice Chairman of the Belize Sugar Cane Farmers Association (BSCFA), BSI is currently offering the cañeros 51 cents per ton of bagasse compared to the farmers' initial request for $10 a ton; however, they (the cane farmers) believe that they should be able to get more for their bagasse, especially since experts have advised them that their price should be in the vicinity of $4 per ton, as a base.

Ortega contended that all the farmers want at the end of the day is a fair payment for BSI's use of their bagasse, and nothing more than that.

In the meanwhile, the 2013/2014 sugar crop season will soon come to an end, and in fact, reports from up north are that it is being contemplated to take place at the end of this month, if not sooner, depending on the cooperation of the weather.

Our readers will recall that the actual start of the 2013/2014 sugar cane crop season was delayed from late last year for some two months up until this January, as the cañeros intentionally stalled the season in an attempt to get BSI and its parent company, ASR, to agree to pay them for bagasse.

At first, BSI had refused to recognize bagasse as a byproduct of sugar cane, then, after several negotiating

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sessions and Government's intervention, a Memorandum of Understanding was ironed out in which the multinational eventually agreed through BSI to pay for bagasse; however, the amount to be paid was not agreed upon, and the groups went into discussions, with the cañeros and BSI/ASR on different sides of the fence, so to speak, on what the payment for the bagasse should be.

While the farmers are hinging their hopes on getting a reasonable payment for bagasse, yesterday, in an interview with the media, the Ministry of Agriculture's Chief Executive Officer, Jose Alpuche, cautioned that the bagasse issue may start looking "like a storm in a teacup" compared to the ominous threat that 2017 presents when Belize's sugar will begin facing competition from sugar beet.

He said, "We're working behind the scenes to ensure that level heads prevail, and that we look at the industry from a holistic standpoint due to the fact that we literally have some serious marketing issues in 2017 that we have to address. Those issues, if they are not addressed properly, will make this whole bagasse issue look like a storm in a teacup. While we might be arguing over the value of the share for bagasse, we better be careful, pay attention and focus on increasing the industry competitiveness to reach the challenges of 2017. That's the big goal. We fully understand it [the bagasse negotiations] is something close to the farmers, [and] we really want to urge the parties to try to reach a negotiated settlement as soon as possible. Government had said that they would be prepared to provide sort of an expert to come in and assist in arriving at a solution that offer still stands. We don't want to get into the details of the negotiations; however, we are more than prepared to provide the expertise required to help guide those negotiations, namely to bring in an expert to look at what could possibly be considered a full formula for payment for bagasse."

Alpuche stated that the Ministry of Agriculture has been dialoguing with the leadership of the cane farming community on those bothersome marketing issues and will soon bring together all stakeholders to resume discussions that were interrupted when the bagasse dispute flared up last year.

Modern sugar mill starts operation in Central Java

PT Gendhis Multi Manis (GMM) has officially started operating a new sugar mill in Blora, Central Java. The mill is touted as among the most modern in the country, with a production capacity of 600 tons of sugar per day.

GMM president director Kamadjaja said that the construction of the sugar mill, which began in June 2011, cost around Rp 1.8 trillion (US$151.77 million). "Of the total investment, Rp 1.2 trillion came from bank loans," he said during the sugar mill's inauguration ceremony on Wednesday last week.

The mill which has the capacity to produce 6,000 tons of cane per day (TCD), the equivalent of 600 tons of sugar is located in Tinapan village in Blora, a major sugar production center in the province. The new sugar mill is the most modern sugar factory in an area where most sugar mills have been in operation since the Dutch colonial era.

"Many sugar mills started to be established in 1870, but afterwards many of them stopped their production," he said, adding that out of 74 sugar mills built in the Dutch colonial period, 11 were located in Central Java.

Currently, sugar demand in Indonesia is 5.75 million tons a year. Only about 40 percent of that demand is supplied by local producers.

"The new mill is expected to meet up to 5 percent of the national demand," Kamadjaja said, adding that he was optimistic the mill could produce quality sugar because the sugar content of locally produced sugarcane was high enough, reaching 8 percent.

The new 43-hectare mill employs more than 1,000 workers and involves around 20,000 sugarcane farmers, who process their cane in the mill under a profit-sharing cooperation.

GMM, Kamadjaja said, would only get 30 percent of the profits, while the farmers would get 70 percent. Government-owned sugar mills only passed on 66 percent of profit to the farmers, he said.

The company is expected to reach the break even point after 8 years of operation, he said, adding that the mill's effective operating time was 11 months because it needed to conduct an annual overhaul that could take one month.

This year, GMM will also build a sugar mill in Madura, East Java, which will have a production capacity four times greater than the Blora sugar mill.

"There is a possibility for the product of the Madura sugar mill to be exported because the [sugar] quality is good," he said.

Meanwhile, Sugarcane Farmers Association (APTRI) chairman Soemitro Samadikoen told tempo.co last Wednesday that presidential candidate Joko "Jokowi" Widodo had promised in a meeting to overhaul state-owned sugar mills to boost national sugar productivity.

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"Jokowi said that if he is elected, he will prioritize sugar mill improvement. Up to five sugar mills will be improved each year," he added.

Nicholls professor receives award

The director of two internationally renowned sugar industry education programs at Nicholls State University was honored for his work in Toronto last week.

(Robert Falgout, retired Nicholls agriculture professor and director of the Cane Sugar Refiners' Institute and the Raw Cane Sugar Manufacturers' Institute, was presented with the Crystal Award for achievement in sugar technology at the international Sugar Industry Technologists annual meeting May 20.)

Robert Falgout, retired Nicholls agriculture professor and director of the Cane Sugar Refiners' Institute and the Raw Cane Sugar Manufacturers' Institute, was presented with the Crystal Award for achievement in sugar technology at the international Sugar Industry Technologists annual meeting May 20.

Falgout, who retired as a professor of agriculture in 1998, has directed the sugar institutes for 37 years. He will retire after teaching his final pair of workshops this summer. The two-week summer programs, aimed at mid-management professionals in the sugar industry, attract attendees and industry experts from all over the nation and up to 40 countries

Sudan Sugar Production Expected to Reach 1, 200,000 Tons by 2016

Khartoum - Sudan's sugar production is expected to reach 1, 200,000 tons in 2016, as against current production of 800 thousand tons, the Minister of Industry, Al-Semaih Al-Siddiq said at a radio forum yesterday. Regarding rise of cement price, the minister said six cement factories are operating in the country, investing $1.6 billion, producing 3.5 million tons. "Said factories are faced with problems of energy cost increase which reflected on cement prices," said the minister. He, however, described the current price per ton as has been fixed by cement dealers under the pretense of the increase of value added. El Sidiq highlighted the industrial development the country has witnessed over the last ten years, citing selfsufficiency achieved in some commodities. He said a 'made in Sudan' exhibition would be held during the period from Shaban 13- Ramadan 6 (June-July), to demonstrate competitiveness of Sudanese industries at regional and international levels. He boastfully spoke of Sudan's expertise which qualifies it to produce high quality industrial products, urging encouraging producers to enhance quality to the highest standards. Reverting to industrial investments, the minister affirmed that his ministry is embarking on preparing the climate for private sector to engage in vertical and horizontal expansion of local industries. He referred to plans to localize some industries such as agricultural and animal products, promising to remove obstacles faced. He refuted talks circulated nowadays about the scarcity of sugar, reassuring citizens of adequate storage to meet consumption during the coming holy month of Ramadan.

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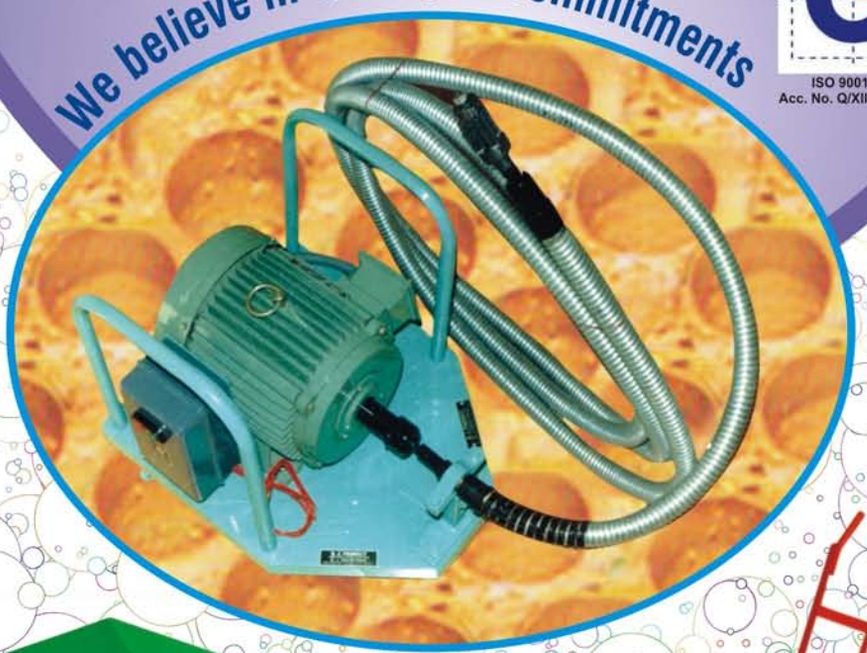

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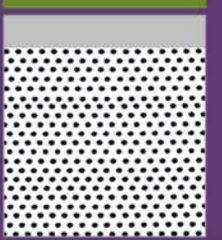

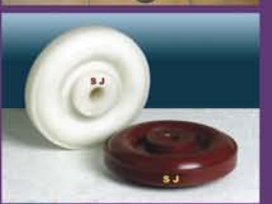

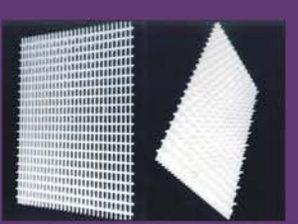

Performance enhancement for crystallization unit of a sugar plant using genetic algorithm technique

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Abstract

This paper deals with the performance enhancement for crystallization unit of a sugar plant using genetic algorithm. The crystallization unit of a sugar industry has three main subsystems arranged in series. Considering exponential distribution for the probable failures and repairs, the mathematical formulation of the problem is done using probabilistic approach, and differential equations are developed on the basis of Markov birth-death process. These equations are then solved using normalizing conditions so as to determine the steady-state availability of the crystallization unit. The performance of each subsystem of crystallization unit in a sugar plant has also been optimized using genetic algorithm. Thus, the findings of the present paper will be highly useful to the plant management for the timely execution of proper maintenance decisions and, hence, to enhance the system performance.

Background :

The sugar industry comprises of large complex engineering systems arranged in series, parallel, or a combination of both. Some of these systems are feeding, crushing, refining, steam generation, evaporation, crystallization, etc. The crystallization unit is one of the most important functionary units of a sugar plant where the sugar crystals are formed. The concentrated juice available in the form of thick syrup from refining unit is heated slowly for long time at low temperature condition resulting into the formation of crystals called crystallization process. The semi-solid juice from the cooking pans of refining unit is first fed to the crystallizers arranged in parallel. Now, the juice mixture consisting of yellowish sugar crystals is suspended in a semi solid mass (molasses or magma). This mixture is processed in centrifuges to separate the sugar crystals from magma. These yellowish sugar crystals are treated chemically to yield white crystals, whereas crystal-free magma is recycled through sulphitors for more recovery. The sugar crystals are then sent to the grading unit,

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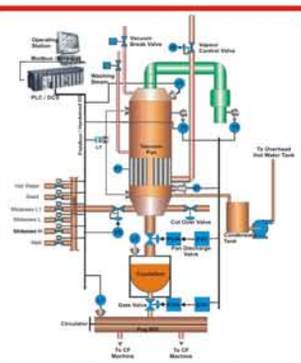

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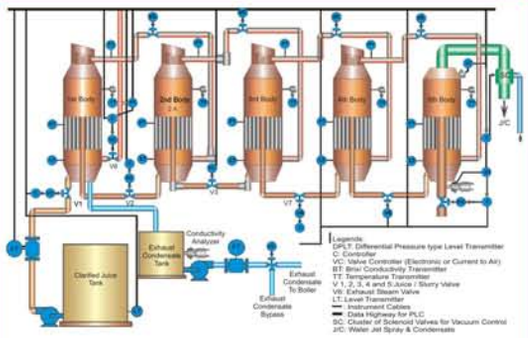

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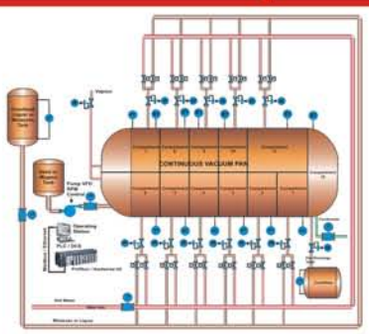
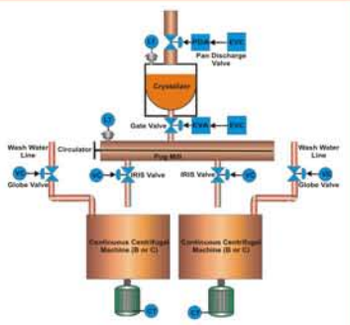


Schematic Diagram
Continuous Vacuum Pan Automation



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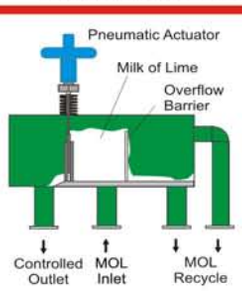

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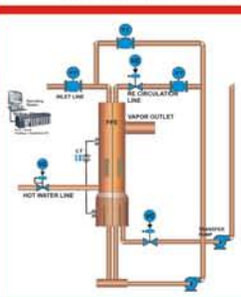
Unit



Falling
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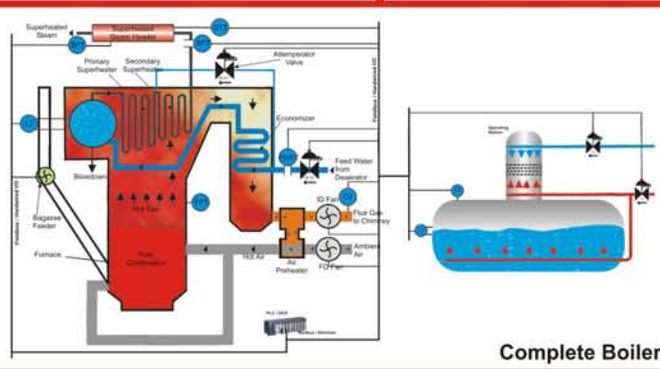
Automation



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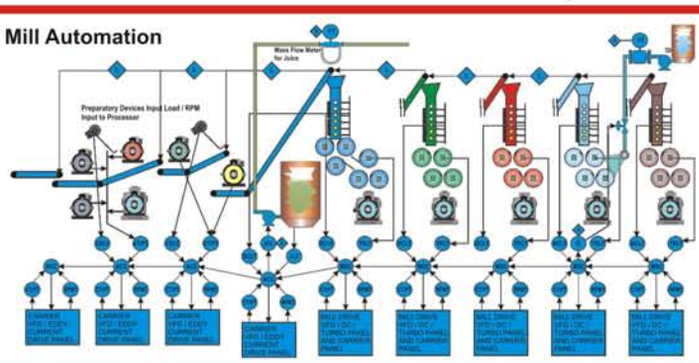

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which comprises of a hopper, elevator, cooler, and grader, arranged in series. It grades the sugar crystals according to their shape and size.

Literature review

The available literature reflects that several approaches have been used to analyze the system performance in terms of reliability and availability. These include reliability block diagram, Monte Carlo simulation, Markov modeling, failure mode and effect analysis, fault tree analysis, and Petri nets (Misra and Weber 1989; Singer 1990; Bradley and Dawson 1998; Modarres et al. 1999; Gandhi et al. 2003; Adamyan and Dravid 2004; Panja and Ray 2007; Bhamare et al. 2008). Dhillon and Singh (1981) have frequently used the Markovian approach for the availability analysis, using exponential distribution for failure and repair times. Kumar et al. (1988, 1989, 1993) used the Markov modeling in the analysis and evaluation of the performances of sugar and urea fertilizer plants. Srinath (1994) has explained a Markov model to determine the

Availability matrices of the three subsystems						
Availability matrices of crystallizer subsystem for crystallization unit						
β_{22}	0.01	0.02	0.03	0.04	0.05	Parameter constraints
α_{22}						
0.01	0.6491	0.8312	0.8953	0.86283	0.9403	
0.02	0.4310	0.6619	0.7770	0.83522	0.8761	
0.03	0.3171	0.5384	0.6736	0.80444	0.8119	$\alpha_{23} = 0.02$; $\beta_{23} = 0.10$;
0.04	0.2496	0.4501	0.5808	0.77276	0.7493	$\alpha_{24} = 0.02$; $\beta_{24} = 0.10$
0.05	0.2053	0.3853	0.5224	0.6224	0.6944	
Availability matrices of centrifuge subsystem for crystallization unit						
β_{23}	0.01	0.02	0.03	0.04	0.05	Parameter constraints
α_{23}						
0.04	0.6491	0.6603	0.6609	0.6611	0.6615	
0.06	0.6216	0.6528	0.6578	0.6591	0.6595	
0.08	0.5887	0.6426	0.6533	0.6566	0.6580	$\alpha_{22} = 0.02$; $\beta_{22} = 0.10$;
0.10	0.5532	0.6301	0.6475	0.6534	0.6500	$\alpha_{24} = 0.02$; $\beta_{24} = 0.10$
0.12	0.5177	0.6157	0.96471	0.6495	0.6536	
Availability matrices of sugar grader subsystem for crystallization unit						
β_{24}	0.01	0.02	0.03	0.04	0.05	Parameter constraints
α_{24}						
0.02	0.4574	0.5387	0.5741	0.5936	0.6059	
0.04	0.3465	0.4547	0.5075	0.5387	0.5594	
0.06	0.2801	0.3933	0.4547	0.4932	0.5195	$\alpha_{22} = 0.01$; $\beta_{22} = 0.02$;
0.08	0.2348	0.3465	0.4118	0.4547	0.4849	$\alpha_{23} = 0.04$; $\beta_{23} = 0.10$
0.10	0.2022	0.3097	0.3764	0.4218	0.4547	

Table 1 Availability matrices of the subsystems for crystallization unit

availability expression for a simple system consisting of only one component. Gupta et al. (2005) have evaluated the reliability parameters of butter manufacturing system in a dairy plant considering exponentially distributed failure rates of various components. The reliability of the system is determined by forming the differential equations with the help of transition diagram using Markovian approach and then solving these differential equations with the help of fourth-order Runge–Kutta method. They applied the recursive method for calculating long-run availability and mean time between failure (MTBF) using numerical technique. Kumar et al. (2007) dealt with the simulated availability of CO2 cooling system in a fertilizer plant.

Gupta et al. (2008) developed the performance models and decision support system for a feed water unit of thermal power plant with the help of mathematical formulation based on Markov birth-death process using probabilistic approach. In this way, the decision matrices are developed which provide the various performance levels for different combinations of failure and repair rates for all subsystems. The model developed helps in to decide about correct and orderly execution of proper maintenance in order to enhance the performance of the feed water unit of the thermal power plant. Khanduja et al. (2008a, b) have discussed availability analysis of bleaching unit of a paper plant. They also developed the performance evaluation system of screening unit in a paper plant. For long-run failure-free operation of the bleaching and screening units, the expression of steadystate availability has been developed, and behavior of each sub-system has also been analyzed.

Deb (1995) has explained the optimization techniques and how they can be used in the engineering problems. Tewari et al. (2000, 2005) dealt with the development of decision support system of refining system of sugar plant. They determined the availability for the refining system with elements exhibiting independent failures and repairs or the operation with standby elements for sugar industry. They also dealt with mathematical modeling and behavioral analysis for a refining system of a sugar industry using genetic algorithm. Ying-Shen et al. (2008) proposed a genetic algorithm-based optimization model to optimize the availability for a series–parallel system. The objective is to determine the most economical policy of component's MTBF and mean time to repair.

In this paper, the mathematical (availability) model has

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6	Mud settling Aid	Sugar tech-G899 HP

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been developed to evaluate the performance of crystallization unit of a sugar plant on the basis of certain assumptions. After that, the perform-ance optimization using genetic algorithm technique (GAT) is done, which gives the optimum unit availability levels for different combinations of failure and repair rates of the subsystems of crystallization unit for improving the performance of the sugar plant. Thus, the findings of the present paper will be highly useful to the plant management in futuristic maintenance planning and control to enhance the unit performance.

The crystallization unit

Crystallization unit consists of three subsystems in series configuration with the following description:

- Subsystem Ai (i = 1 to 6): It consists of six crystallizer units connected in parallel. The failure of any one reduces the capacity of the system and, hence, loss in production. Complete failure occurs when more than one unit fail at a time.
- Subsystem Aj (j = 1 to 19): It consists of nineteen centrifuge units connected in parallel. Complete failure occurs when more than two units fail at a time.
- Subsystem Ak (k = 1 to 4): It consists of four sugar grader units connected in series. The failure of any one causes the complete failure of the system.

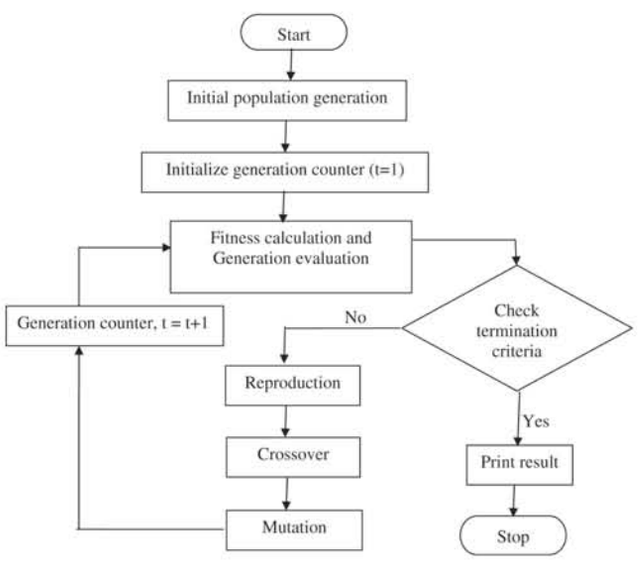

Figure 1 Flow chart for typical genetic algorithm technique.

Assumptions

The assumptions used in the probabilistic model are the following:

1. Failure/repair rates are constant over time and statistically independent.
2. A repaired unit is as good as new and performance wise for a specified duration.
3. Sufficient repair facilities are provided, i.e., no waiting time to start the repairs.
4. Standby units (if any) are of the same nature and capacity as the active units.
5. System failure/repair follows exponential distribution.
6. Service includes repair and/or replacement.
7. System may work at a reduced capacity/efficiency.
8. There is no simultaneous failure among the system. However, simultaneous failure may occur among various subsystems in a system/unit.

Population size	Availability	α_{22}	β_{22}	α_{23}	β_{23}	α_{24}	β_{24}
20	0.9458	0.0387	0.3737	0.0209	0.4537	0.0202	0.4717
40	0.9455	0.0132	0.2172	0.0290	0.4974	0.0209	0.4721
60	0.9474	0.0249	0.3668	0.0208	0.4384	0.0205	0.4940
80	0.9480	0.0178	0.2555	0.0229	0.4117	0.0206	0.4995
100	**0.9491**	**0.0205**	**0.2823**	**0.0207**	**0.4406**	**0.0203**	**0.4905**
120	0.9491	0.0205	0.2823	0.0207	0.4406	0.0203	0.4905

Mutation probability = 0.015; number of generation = 150; crossover probability = 0.875.

Table 2 Effect of population size on availability of the crystallization unit using genetic algorithm

Notations

The following notations are associated with the crystallization unit:

- α_i, β_i
  $i = 22, 23, 24$
  Respective failure and repair rates of various subsystems
- $P_i(t)$
  Probability function that the unit is in a particular state at time 't'
- $P_i'(t)$
  Derivative of probability function $P_i(t)$

Performance modeling

The mathematical modeling is carried out and done using simple probabilistic considerations and differential equations which are developed on the basis of Markov birthdeath process. These equations are further solved for determining the steady-state availability of crystallization unit. Various probability considerations give the following differential equations associated with the crystallization unit:

- State 0 - full capacity working with no standby
- State 1 to 5 - reduced capacity working
- State 6 to 16- represents the system in failed state

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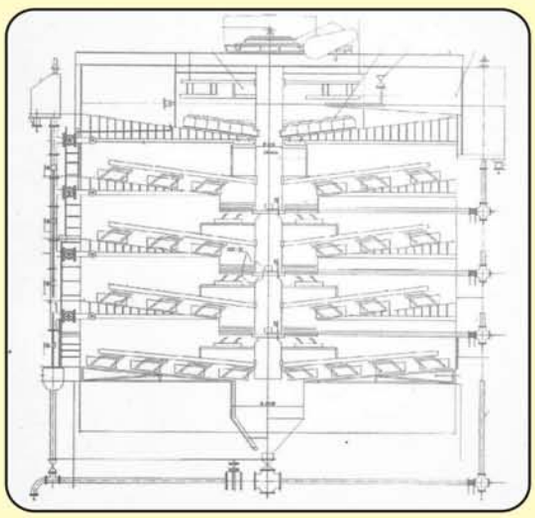

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$$P_0'(t) + \sum \alpha_r P_0(t) = \sum \beta_j P_k(t) \quad (1)$$

$$P_1'(t) + \sum \alpha_r P_1(t) = \sum \beta_j P_k(t) \quad (2)$$

$$P_2'(t) + \sum (\alpha_r \beta_{23}) P_2(t) = \sum \beta_j P_5(t) + \alpha_{23} P_0(t) \quad (3)$$

$$P_3'(t) + \sum (\alpha_r + \beta_m) P_3(t) = \sum \beta_j P_k(t) + \alpha_{23} P_1(t) + \alpha_{22} P_2(t) \quad (4)$$

$$P_4'(t) + \sum (\alpha_r \beta_{23}) P_4(t) = \sum \beta_j P_k(t) + \alpha_{23} P_2(t) \quad (5)$$

$$P_5'(t) + \sum (\alpha_r \beta_m) P_5(t) = \sum \beta_j P_k(t) + \alpha_{22} P_4(t) + \alpha_{23} P_3(t) \quad (6)$$

$$P_i'(t) + \beta_m P_i(t) = \alpha_m P_1(t) \quad (7)$$

By putting $d/dt = 0$ as $t \to \infty$ in Equations 1 to 7, the steady-state probabilities are given as follows:

$$\sum \alpha_r P_0 = \sum \beta_i P_k$$

$$\sum \alpha_r P_1 = \sum \beta_i P_k$$

Now, the steady-state availability of the crystallization unit may be obtained as the summation of all the working state probabilities, i.e.,

$$\sum (\alpha_r + \beta_m) P_3 = \sum \beta_i P_k + \alpha_{23} P_1 + \alpha_{22} P_2$$

$$\sum (\alpha_r + \beta_m) P_5 = \sum \beta_i P_k + \alpha_{22} P_4 + \alpha_{23} P_3$$

$$P_i = (\alpha_m / \beta_m) P_1$$

The probability of full capacity working *viz.* P_0 is determined by normalizing condition, i.e.,

$$\sum_{i=0}^{16} P_i = 1$$

Substituting the values of P_1 to P_{16} in terms of P_0 into normalizing condition, we get

$$P_0 N = 1$$

Let

$$A = \alpha_{22}/\beta_{22}, B = \alpha_{23}/\beta_{23}, C = \alpha_{24}/\beta_{24}$$

$$X_1 = \alpha_{22} + \alpha_{23} - (\alpha_{22} * \beta_{23}/(\alpha_{22} + \beta_{23}))$$

$$X_2 = \beta_{22} + (\alpha_{23} * \beta_{22}/(\alpha_{22} + \beta_{23}))$$

$$X_3 = X_1/X_2$$

$$X_4 = (\alpha_{22} + \alpha_{23} - \beta_{22} * X_3)/\beta_{23}$$

$$X_5 = (\alpha_{23}/\beta_{23})^2 * \beta_{23} + \alpha_{23} * X_4.$$

Then,

$$N = 1 + X_3 + X_4 + B * X_3 + X_5 + B^2 * X_3 + B * X_5 + B^3 * X_3 + C * B^2 * X_3 + A * B^2 * X_3 + A * B * X_3 + C * B * X_3 + A * X_3 + C * X_3 + C + C * X_4 + C * X_5$$

Table 3 Effect of number of generation on availability of the crystallization unit using genetic algorithm

Number of generations	Availability	α_{22}	β_{22}	α_{23}	β_{23}	α_{24}	β_{24}
100	0.895029	0.01070	0.04914	0.04345	0.38526	0.02055	0.48939
150	0.895665	0.01030	0.04658	0.04026	0.44370	0.02075	0.47348
200	0.896551	0.01125	0.04951	0.04052	0.37082	0.02028	0.49569
250	0.902337	0.01013	0.04999	0.04123	0.45499	0.02076	0.47859
300	**0.903933**	**0.01001**	**0.04978**	**0.04033**	**0.46868**	**0.02049**	**0.47530**
350	0.903933	0.01001	0.04978	0.04033	0.46868	0.02049	0.47530

Mutation probability = 0.015; population size = 150; crossover probability = 0.875.

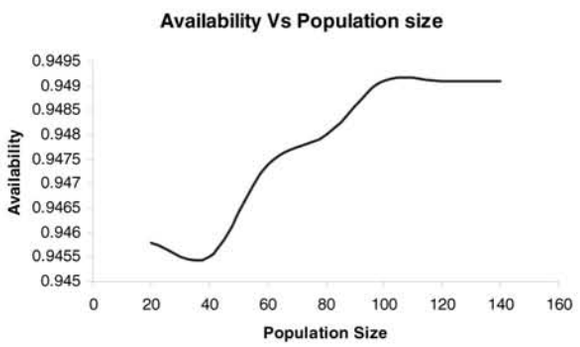

Figure 2 Effect of population size on crystallization unit availability.

$$\text{Availability} = \sum_{i=0}^{5} P_i$$

or

$$\text{Availability(Av.)} = (1/N)[1 + X_3 + X_4 + X_5 + B * X_3 + B^2 * X_3]$$

Performance analysis

From the maintenance history sheet of crystallization unit of sugar plant and the detailed discussions with the plant personnel, appropriate failure and repair rates of

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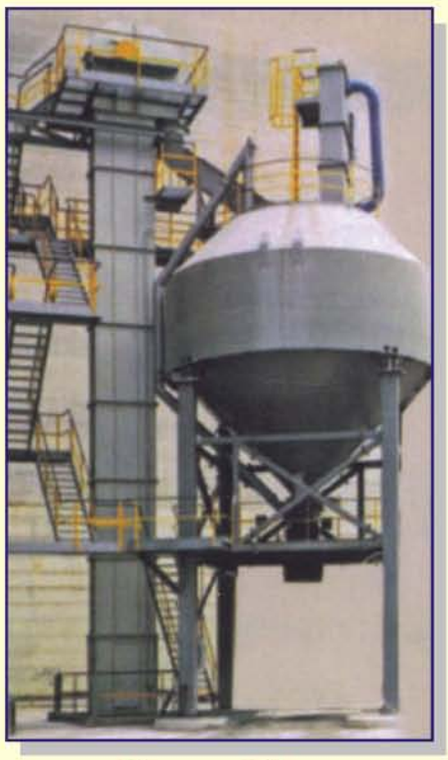

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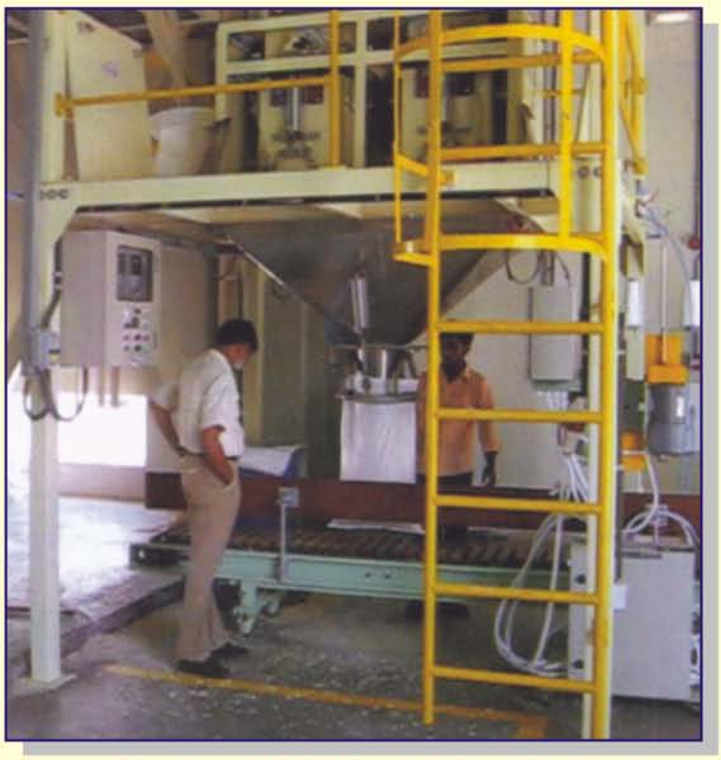

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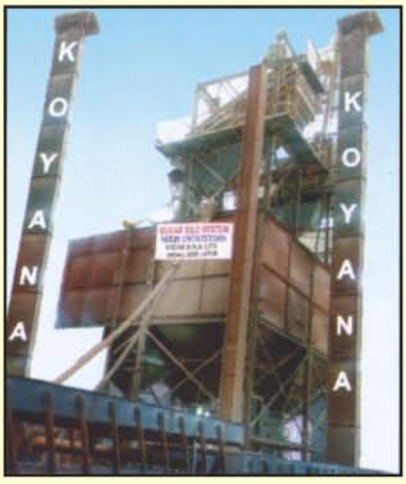

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all the subsystems are taken, and availability matrices (performance values) are prepared accordingly by putting these failure and repair rate values in expression of availability for P_0. This deals with the quantitative analysis of all the factors viz. courses of action and states of nature, which influence the maintenance decisions associated with the crystallization unit. These availability models are developed under the real decision-making environment, i.e., decision making under risk (probabilistic model) and used to implement the proper maintenance decisions for the crystallization unit of sugar plant.

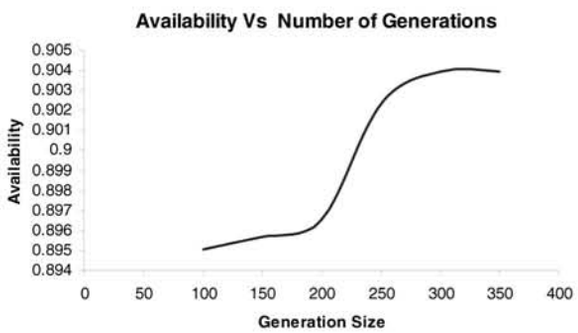

Figure 3 Effect of number of generations on crystallization unit availability.

Table 1 represents the availability matrices for various subsystems of the crystallization unit. These matrices simply reveal the various performance levels for different combinations of failure and repair rates/priorities. It also depicts the effect of failure/repair rate of all the subsystems on crystallization unit performance. On the basis of analysis, one may select the best possible combinations (α_i, β_i) to increase the unit availability. Table 1 shows optimal availability level for all the subsystems (for crystallizer is 0.9403; for centrifuge, 0.6615; for sugar grader, 0.6059) which can be optimized using genetic algorithm technique.

Genetic algorithm technique

Genetic algorithms (GA) are computerized search and optimization algorithms based on the mechanics of natural genetics and natural selection (Figure 1). Genetic algorithms have become important because they are found to be potential search and optimization techniques for complex engineering optimization problems. The action of GAT for parameter optimization in the present problem can be stated as follows:

1. Initialize the parameters of the genetic algorithm.
2. Randomly generate the initial population and prepare the coded strings.
3. Compute the fitness of each individual in the old population.
4. Form the mating pool from the old population.
5. Select two parents from the mating pool randomly.
6. Perform the crossover of the parents to produce two off springs.
7. Mutate if required.
8. Place the child strings to new population.
9. Compute the fitness of each individual in new population.
10. Create best-fit population from the previous and new population.
11. Repeat the steps 4 to 10 until the best individuals in new population represent the optimum value of the performance function (unit availability).

The performance behavior of the crystallization unit is highly influenced by the failure and repair parameters of each subsystem. These parameters ensure high performance of the crystallization unit. GAT is hereby proposed to coordinate the failure and repair parameters of each subsystem for stable system performance, i.e., high availability. Here, the number of parameters is six (three failure parameters and three repair parameters). The design procedure is described as follows: To use GAT for solving the given problem, the chromosomes are to be coded in real structures. Here, concatenated, multi-parameter, mapped, fixedpoint coding is used. Unlike, unsigned fixed-point integer coding parameters are mapped to a specified interval $[X_{min}, X_{max}]$, where X_{min} and X_{max} are the maximum and minimum values of system parameters. The maximum value of the availability function corresponds to the optimum values of system parameters. These parameters are optimized according to the performance index, i.e., desired availability level. To test the proposed method, failure and repair rates are determined simultaneously for optimal value of unit availability. Effects of population size and number of generations on the availability of crystallization unit are shown in Tables 2 and 3. To specify the computed simulation more precisely, trial sets are also chosen for GA and system parameters. The performance (availability) of the crystallization unit is determined by the designed values of the unit parameters.

Failure and repair rate parameter constraints

$(\alpha_{22}, \beta_{22}, \alpha_{23}, \beta_{23}, \alpha_{24}, \beta_{24})$

α_{22}, [A1] $\epsilon(0.01, 0.05)$	$\alpha_{23}, \epsilon(0.04, 0.12)$	$\alpha_{24}, \epsilon(0.02, 0.10)$
$\beta_{22}, \epsilon(0.01, 0.05)$	$\beta_{23}, \epsilon(0.01, 0.05)$	$\beta_{24}, \epsilon(0.01, 0.05)$

Here, real-coded structures are used. The simulation is done to a maximum number of population size, which is

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varying from 20 to 120. The effect of population size on availability of the crystallization unit is shown in Figure 2. The optimum value of unit's performance is 94.91%, for which the best possible combination of failure and repair rates is $\alpha_{22} = 0.0205$, $\beta_{22} = 0.2823$, $\alpha_{23} = 0.0207$, $\beta_{23} = 0.4406$, $\alpha_{24} = 0.0203$, and $\beta_{24} = 0.4905$ at population size 100 as given in Table 2.

Now, the simulation is done to a maximum number of generations, which is varying from 100 to 350. The effect of number of generations on availability of the crystallization unit is shown in Figure 3. The optimum value of unit's performance 90.39%, for which the best possible combination of failure and repair rates is $\alpha_{22} = 0.01001$, $\beta_{22} = 0.04978$, $\alpha_{23} = 0.04033$, $\beta_{23} = 0.46868$, $\alpha_{24} = 0.02049$, and $\beta_{24} = 0.47530$ at generation size 300 as given in Table 3.

Conclusions

The performance optimization of crystallization unit of a sugar plant is discussed in this paper. Genetic algorithm technique is hereby proposed to select the various feasible values of the unit failure and repair parameters. Then, GAT is successfully applied to coordinate simultaneously these parameters for an optimum level of unit performance. Besides, the effect of GA parameters such as population size and number of generations on unit performance, i.e., availability, has also been discussed. The findings of this paper are discussed with the concerned sugar plant management. Such results are found highly beneficial for the purpose of performance enhancement of a crystallization unit in the sugar plant concerned.

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AdaptiveWavelet TransformMethod to Identify Cracks in Gears

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Many damages and faults can cause problems in gear unit operation. A crack in the tooth root is probably the least desirable among them. It often leads to failure of gear unit operation. By monitoring vibrations, it is possible to determine the presence of a crack. Signals are, however, very noisy. This makes it difficult to define properties of individual components. Wavelet analysis is an effective tool for analysing signals and for defining properties. In this paper, a denoising method based on wavelet analysis, which takes prior information about impulse probability density into consideration, is used to identify transient information from vibration signals of a gear unit with a fatigue crack in the tooth root.

1. Introduction

The aim of maintenance is to keep a technical system (gear unit) in the most suitable working condition, and its purpose is to discover, to diagnose, to foresee, to prevent and to eliminate damages. The purpose of modern maintenance, however, is not only to eliminate failures but also to define the stage of a potential danger of a sudden failure of system operation. The aim of diagnostics is to define the current condition of the system and the location, shape, and reason of damage formation. The following diagnostic values are used to define incorrect operation, the possibility and location of damages, and the possibility of elimination of these damages: different signals, condition parameters, and other indirect signs. Identification of the form of damage is based on deviations from the values typical of a faultless gear system.

Gear units are often used in various industrial applications. Consequently, it is of utmost significance to identify fault symptoms of a gear unit at an early stage. It is vibration signals that are primarily used to identify

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faults but they are always complex and it is difficult to identify faults in gear units on the basis of vibration signals. Acquired vibration signals often contain a lot of noise. With too much noise, the useful information is corrupted to such an extent that it is impossible to establish the condition or that a wrong conclusion is made.

A gear unit consists of elements enabling the transmission of rotating movement. Although a gear unit is a complex dynamic model, its movement is usually periodical; faults and damages represent a disturbing quantity or impulse. Local and time changes in vibration signals indicate the disturbance [1, 2] and it is possible to expect time-frequency changes [3]. This idea is based on kinematics and operating characteristics [4, 5].

It is of key importance to apply effective methods for the identification (extraction) of properties from noisy signals. Wavelet analysis is one such effective tool. It is especially suitable when it comes to processing nonstationary signals. Local energy distributions in time domain and frequency domain are typical of transient property components of vibration signals, which resemble a wavelet function. It is possible to use wavelet functions to detect transient property components due to similar structures. It is possible to apply wavelets to extract features and purge noise. Matching pursuits by Mallat [6] and softthreshold denoising by Donoho and Johnstone [7, 8] are among such procedures. Threshold in the wavelet domain is used for threshold denoising. It is possible to present that this is asymptotically almost optimal for many signals, which have been corrupted by additive white Gaussian noise. However, feature components of many mechanical dynamic signals consist of impulse components. This method, however, has not been proved effective for impulse component extraction. Smoothness of the signal that will be isolated is assumed by all previously mentioned methods, based on orthogonal wavelet transforms. The transient components, which are treated as noise, vary quickly. Some of these methods result in an even greater smoothness than in case of the original signal. Consequently, existing denoising methods are not suitable for vibration analysis of signals produced by gears as impulses that need to be isolated are not smooth. For threshold denoising, Morlet wavelet is used, and similarity between theMorlet wavelet and impulse is applied. If nonorthogonal wavelet transform is used, this does not ensure that, after the transform, independent and identically distributed noise retains this characteristic on each scale. After nonorthogonal wavelet transforms, statistical noise attributes become different as rules that apply for thresholding when orthogonal wavelet transforms are used are not suitable for thresholding when nonorthogonal wavelet transforms are involved.

The technique with high-order statistics was sometimes more successful. The shape of the amplitude distribution of vibration data is described on the basis of statistical moments. However, oversensitivity to vibration and noise is characteristic of higher moments whereas lower moments are less sensitive to early-stage fault. As a result, in relation to statistical moments used in practice, only the fourth normalized moment (kurtosis) and third normalized moment are useful. If a defect must be identified at a very early stage, kurtosis is preferred over the third moment as this implies higher sensitivity to impulse signals [9]. Thus, the third and fourth moments have some disadvantages, and to eliminate these disadvantages, a class of new diagnostic gear failure indexes have been derived, based on Renyi entropy, to describe vibration signature and to optimise the parameter of the wavelets. They present, so to speak, a generalization of traditional statistical moments. Nannone and Morabito [10] used wavelet entropy to extract features fromcomplex signals in medicine, and Tao et al. [11] and Qiu et al. [12] used in mechanical systems.

In order to make denoising more effective, a new denoising method based on Morlet wavelet with adjustment of the shape of the wavelet filter based on the Renyi entropy and maximum likelihood estimation denoising method for non-Gaussian data is proposed in this paper; this method is particularly useful to extract impulse components. With the new specific threshold rule, based on the maximum likelihood estimation, the information regarding the probability density function of the impulse is taken into consideration.

2.Wavelet Analysis

The continuous wavelet transform of function $x(t) \in L^2(R)$ at the time and scale is expressed as follows [6]:

$$\begin{aligned} Wx(u,s) &= \langle x, \psi_{u,s} \rangle \\ &= \int_{-\infty}^{+\infty} x(t) \cdot \frac{1}{\sqrt{s}} \cdot \psi^* \left(\frac{t-u}{s} \right) \cdot dt \\ &= \frac{1}{\sqrt{s}} \sum_{t=1}^{n} x(t) \cdots \psi^* \left(\frac{t-u}{s} \right), \end{aligned} \quad (1)$$

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$$\overline{\psi}_s(t) = \frac{1}{\sqrt{s}} \cdot \psi^*\left(\frac{-t}{s}\right), \quad (2)$$

$$\overline{\Psi}_s(\omega) = \sqrt{s} \cdot \Psi^*(s \cdot \omega), \quad (3)$$

where the transform is presented as the product of convolution; (2) presents the expression of an average wavelet function and the corresponding Fourier integral transform, (3).

At the continuous wavelet transform, the observed function x(t) ismultiplied by a group of shifted and scaled wavelet functions. A simultaneous change in time and frequency dissemination of the continuous wavelet transform can be observed. Wavelets, as locally limited functions, are used to analyse the observed function x(t). The continuous wavelet transform is very sensitive to local nonstationarities.

Morlet wavelet function, which is a representative of a nonorthogonal wavelet function:

$$\psi_{\text{Morlet}}(t, \sigma, \eta) = \frac{1}{\sqrt[4]{\pi}} \cdot e^{-t^2/2} \cdot e^{i \cdot \eta \cdot t}. \quad (4)$$

Equation (5) yields a family of wavelet functions or a shifted u and scaled s Morlet wavelet function is

$$\psi_{\text{Morlet}}(t, \sigma, \eta) = \frac{1}{\sqrt{s}} \cdot \frac{1}{\sqrt[4]{\pi}} \cdot e^{-(1/2) \cdot ((t-u)/s)} \cdot e^{i \cdot \eta \cdot ((t-u)/s)}. \quad (5)$$

Various wavelet basis functions were selected in wavelet applications. Theoretically speaking, any function that is finite in time and frequency can be used for the basis function. Several types of functions can be used as a wavelet basis; the selection depends on the applicationrelated requirements [13, 14].

The Morlet wavelet was used as the basis function due to the similarity of formulation with Gabor transform function that was researched in our laboratory. The Gabor transform has some properties in Fourier transforms. The only difference between the Morlet wavelet and Gabor transform is in the exponent term, which helps determine the shape of the wavelet.

Using the expression in (5), the time function can be further transformed to the frequency domain as shown below:

$$\hat{\psi}_{\text{Morlet}}(\omega, \sigma) = \sqrt[4]{\pi} \cdot \sqrt{\frac{2 \cdot \pi}{s}} \cdot e^{-i \cdot \omega \cdot u} \cdot e^{-(\omega - (\eta/s))^2 \cdot (s^2/2)}. \quad (6)$$

The Morlet wavelet is a complex wavelet and it can be decomposed into two parts—one of them for the real part and the other one for the imaginary part:

$$\psi_{\text{Morlet real}}(t, \sigma, \eta) = \frac{1}{\sqrt{\pi}} \cdot e^{-\beta^2 \cdot (t^2/2)} \cdot \cos(\omega \cdot t),$$
$$\psi_{\text{Morlet imag}}(t, \sigma, \eta) = \frac{1}{\sqrt{\pi}} \cdot e^{-\beta^2 \cdot (t^2/2)} \cdot \sin(\omega \cdot t), \quad (7)$$

where β is the shape parameter, balancing time resolution and frequency resolution of the Morlet wavelet.

It is evident from (6) that the shape of the basic wavelet is controlled by parameter β. With the reduction of β, the frequency resolution will increase whereas time resolution will decrease.When β tends to be infinite, theMorlet wavelet becomes a Dirac function with the finest time resolution. With β tending to be 0, the Morlet wavelet becomes a cosine function with the finest frequency resolution. Therefore, there is always an optimal β with the best time-frequency resolution for a certain signal localized in the time-frequency plane.

Only the real part is usually used. The real part of the Morlet wavelet is a cosine signal decaying exponentially on the left and right side, and its function shape is similar to an impulse. Because of this similarity the Morlet wavelet is widely used in mechanical fault diagnostic applications.

By time translation and scale dilation, a daughter Morlet wavelet is acquired from the mother wavelet:

$$\psi_{\text{Morlet}}(t, \sigma, \eta) = \frac{1}{\sqrt{\pi}} \cdot e^{-\beta^2 \cdot (t(t-u)^2/(2 \cdot s^2))} \cdot \cos\left(\frac{\pi \cdot (t-u)}{s}\right), \quad (8)$$

where *s* is the scale parameter for dilation and *u* for time translation. It is possible to construct, by selecting parameters s and *u*, a daughter Morlet wavelet closely matching the shape of a mechanical impulse.

It is required to first define the location and shape of the frequency band corresponding to the impulses in order to define the impulses by means of filtering. Location and shape of the daughter Morlet wavelet are controlled by scale *s* and parameter β. Due to this, it is possible to, by optimising the two parameters for a daughter wavelet, build an adaptive wavelet filter. The selection of the mother wavelet that adapts best to the signal to be isolated was dealt with by several researchers [15–17]. It is not required to carry out optimal wavelet reconstruction but to find the best daughter wavelet. Differences between single and doublesided Morlet wavelets were dealt with by Wang [18]. Their frequency spectra are quite different. A real impulse is usually nonsymmetric, and, consequently, the right-hand side of Morlet wavelet was selected to be used as the basis. Such wavelets should be most appropriate to match the behaviour of hidden impulses.

It is required to determine the location and shape of the frequency band corresponding to the impulses in order

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to identify the immersed impulses by means of filtering. As a result, it is possible to form an adaptive wavelet filter by optimising the parameter β for a daughter wavelet. Here it is presented how to find the best wavelet filter (the daughter wavelet of a Morlet wavelet) instead of optimal wavelet reconstruction.

In relation to optimising the wavelet base, sparsity is usually applied in order to evaluate the wavelet base. Since the wavelet that corresponds to the smallest number of signal wavelet transformation coefficients is the most optimal, it is possible to define the value β by establishing which wavelet coefficients are the sparsest. Renyi entropy can be applied to measure the diversity of a possibility series. It is, therefore, possible to use entropy of wavelet coefficients to measure sparsity of coefficients of these wavelets.

Renyi entropy, which is sometimes referred to asmeasure of uncertainty, is of a random variable and is determined on the basis of its probability distribution. It is possible to present it as a good measure of randomness and sparseness.

Entropy, as information measure of randomicity of random events, depends on event probability distribution. By analogy, considering signal amplitude distribution, entropy is sensitive also to the shape of discrete signals amplitude distribution. Small entropy values are associated with peak signals for which small numbers of large amplitude components are typical; on the other hand large entropy values are related to signals dominated by equal amplitude components. It is possible to consider wavelet transform coefficients with minimal Renyi entropy as the sparsest result. By means of this typical feature, Renyi entropy, on the basis of which a class of new diagnostic indices are derived in order to carry out condition monitoring of gear units, has introduced a generalized statistical moment concept along with its analytic expression.

Renyi entropy is sensitive to sharp variant structures in signal, for example, impulses. Consequently it is applied to detect fault symptoms [19]. The bigger the impulse in signals, the smaller the Renyi entropy value.

Renyi entropy definition is based on the theory of means [19]:

$$H = \varphi^{-1}\left(\sum_{k=1}^{N} p_k \varphi(I(p_k))\right), \tag{9}$$

where φ (-) is a continuous and strictly monotonic function subclass of Kolmogorov-Nagumo functions. To meet the constraints of an information measure,

$$\varphi(x) = \{x \text{ Shanon Entropy}, \quad 2^{(1-\alpha)\cdot x} \text{ Renyi Entropy with order } \alpha\}. \tag{10}$$

$I(p_k)$ is any information measure. By simplifying the above relation,

$$H_\alpha = \frac{1}{1-\alpha}\log_2\left(\sum_{k=1}^{N} p_k^\alpha\right), \quad \alpha > 0,\ \alpha \neq 1. \tag{11}$$

The third order Renyi entropy ($\alpha = 3$) is calculated on the basis the wavelet representations:

$$H_{W_3} = -\frac{1}{2}\log_2\left\{\iint_{-\infty}^{\infty} W^3(a,b)da\,db\right\}. \tag{12}$$

3.Wavelet Denoising : The aim of wavelet threshold denoising method, which was introduced by Donoho [7], is to remove independent and identically distributed Gaussian noise. A signal series $x(t) = \{x_1(t), x_2(t), \ldots, x_n(t)\}$, which is acquired using a sensor, consists of impulses and noise. It is possible to express $x(t)$ as follows:

$$x(t) = p(t) + n(t), \tag{13}$$

where $p(t) = \{p_1(t), p_2(t), \ldots, p_n(t)\}$ denotes the impulses to be determined whereas $n(t) = \{n_1(t), n_2(t), \ldots, n_n(t)\}$ denotes the noise with mean zero and standard deviation σ.

Wavelet threshold denoising method is based on the idea of the concentration of energy of the signal that needs to be identified on a few wavelet coefficients and of the spreading of noise energy throughout all wavelet coefficients. It is of importance to make signal concentrate on fewer coefficients, in relation to which similarity between basic wavelet and signal that must be identified plays an important role. The components of the impulse must be made as expressed as possible in order to improve the impulse isolation performance.

It is assumed by all traditional methods that noise properties are known, meaning that the noise is independent and identically distributed. In industrial applications, however, some data on the signal to be detected is often available but the exact behaviour of the noise is not known. The maximum likelihood estimation denoising method is suitable for non-Gaussian data.

Prior information on the impulse probability density function is taken into consideration in a specific threshold rule, based on the maximum likelihood estimation method. As to this rule, it is not necessary that the noise is independent and identically distributed Gaussian. It is, however, required to know in advance the probability density function of the impulse to be

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defined.

Hyvarinen introduced the so-called "sparse code shrinkage" method, which estimates non-Gaussian data under noisy conditions and is based on the maximum likelihood estimation principle [20].

For a very sparse probability density function, Hyvarinen [20] used the following function to represent a sparse distribution:

$$p(s) = \frac{(\alpha+2)\cdot(0.5\cdot\alpha\cdot(\alpha+1))^{0.5\cdot\alpha+1}}{2\cdot d\cdot\left(\sqrt{0.5\cdot\alpha(\alpha+1)}+|s/d|\right)^{\alpha+3}}, \qquad (14)$$

where d indicates the standard deviation of the impulse to be isolated whereas α indicates the parameter controlling the sparseness of the probability density function.

For an impulse, in relation to which the probability density function can be represented by (9), Hyvarinen used the sparse shrinkage threshold rule [20]:

where $\sigma = \sqrt{0.5\cdot\alpha\cdot(\alpha+1)}$ indicates the standard deviation of the noise.

The following steps are used for the denoising method based on appropriate wavelet Morlet filter.

(1) The procedure of achieving the appropriate wavelet. In order to produce different daughter wavelets, modify the parameters β.

(2) Calculate the entropy for each daughter wavelet.

(3) To identify hidden impulses, it is very appropriate to use the parameter β corresponding to the minimum Renyi entropy.

(4) Signal decomposition. To perform a wavelet transform for the signal, use the Morlet wavelet with appropriate parameter β corresponding to the minimum Renyi entropy. To obtain the wavelet coefficients, use (8).

(5) To shrink the wavelet coefficients, use the threshold rule from (15).

(6) Signal reconstruction. Perform the inverse transform of the shrunken wavelet coefficients. The result represents an approximation to the impulse to be isolated. Let *Wx(u,s)* be econstructed coefficients. Then, to purify the signal, use the following equation [6]:

$$x(t) = \frac{1}{C_\psi}\cdot\iint_{-\infty}^{+\infty} Wx(u,s)\cdot\frac{1}{\sqrt{s}}\cdot\psi\left(\frac{t-u}{s}\right)\cdot du\cdot\frac{ds}{s^2}. \qquad (16)$$

4. Practical Example

The test used for the measurements is shown in Figure 1. It belongs to the Computer Aided Design Laboratory of the Faculty of Mechanical Engineering, University of Maribor.

A single stage gear unit EZ6.B3.132 produced by Strojna Maribor was used. A helical gear unit with straight teeth was integrated into the gear unit [9]. The pinion had 19 and the wheel 34 teeth. Each gear unit had a carburised spur gear pair (module:4 mm). Accelometers for measuring vibrations were fixed on the housings. Tests were carried out under constant loads. The presented results refer to a nominal pinion torque of 30Nmand a nominal pinion speed of 1200 rpm (20 Hz), which is, in industrial applications, a very typical load condition for this type of gear units.

We used a standard ground gear pair, shown in Figure 2, with teeth quality 6 but with a 4.5mm crack in a tooth root of a pinion. Measurements were performed under the operating conditions typical of this type of a gear unit. The measurement process and analysis preparations are presented in detail in [9].

Figure 1: Test plant.

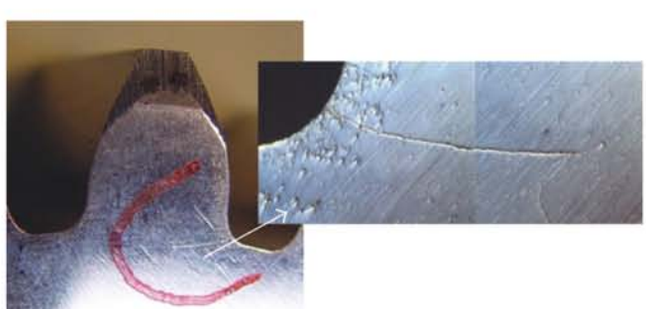

Figure 2: Pinion with a fatigue crack in the tooth root [21].

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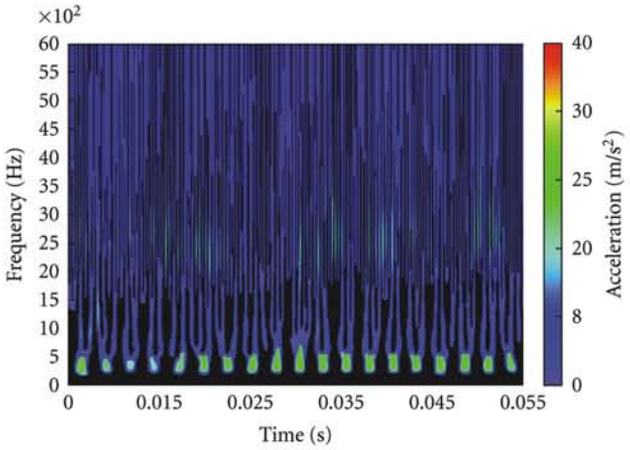

Figure 3: Frequency scalogram of wavelet coefficient of the reference gear unit.

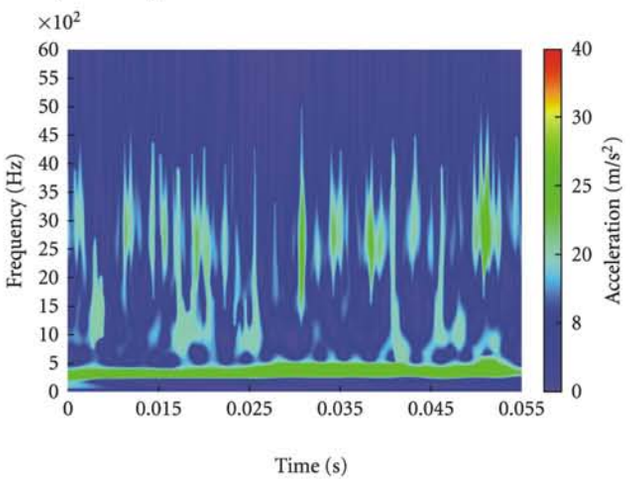

Figure 4: Frequency scalogram of square wavelet coefficient of the reference gear unit.

root of a pinion. Measurements were performed under the operating conditions typical of this type of a gear unit. The measurement process and analysis preparations are presented in detail in [9].

4.1. Comparison Analysis of Practical Signals. To carry out first comparisons, continuous wavelet transform for tested gear unit with frequency scalograms was prepared.

Morlet wavelet function represents normalised and square values of wavelet coefficients amplitudes. The representation is carried out in a time-frequency domain due to the established connection between the scale and frequency. It is much simpler to establish adequate characteristics in time-frequency domain (frequency scalogram) than in time-scale domain (scalogram). Consequently, this is very appropriate when it comes to technical diagnostics. The energy of wavelet transform equals the energy of the original signal in time domain as, on the basis of normalization, the transform matches the Parseval characteristic of energy preservation.

The continuous wavelet transformwith parameters $\eta = 6$ and $\sigma = 1$ was used. The representation of the frequency scalogram is in the form of wavelet coefficients or their square values. The analysis was based on a part of the signal only, representing one whole rotation of the gear (of a pinion with a crack), which took 50ms.

No particularities, which would denote local changes, can be observed from the figures, in the frequency scalogram, when it comes to the faultless gear. This applies both for a normal representation (Figure 3) of wavelet coefficients and for a square representation (Figure 4) of wavelet coefficients. When it comes to normal representation of wavelet coefficients (Figure 3), the resolution is much better in the lower frequency area; the reaction of each single tooth at the frequency of 380 Hz is expressed there. A minimum local change in wavelet coefficients, at 11 ms, can be noticed in the signal caused by a gear with a crack in frequency scalograms with square representation (Figure 5). In normal representation of wavelet coefficients, it is not possible to define the changes (Figure 6). For those techniques, a reference signal was used.

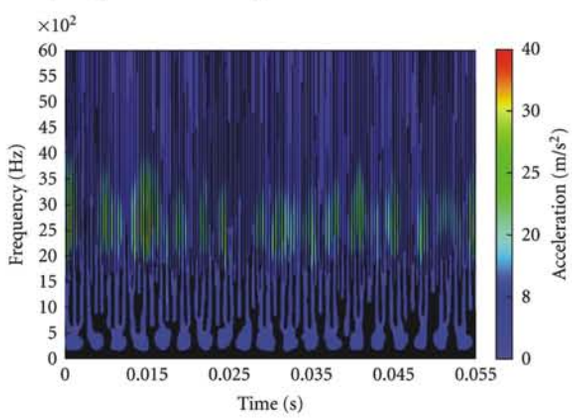

Figure 5: Frequency scalogram of wavelet coefficient of the gear unit with a gear with a crack in a tooth root.

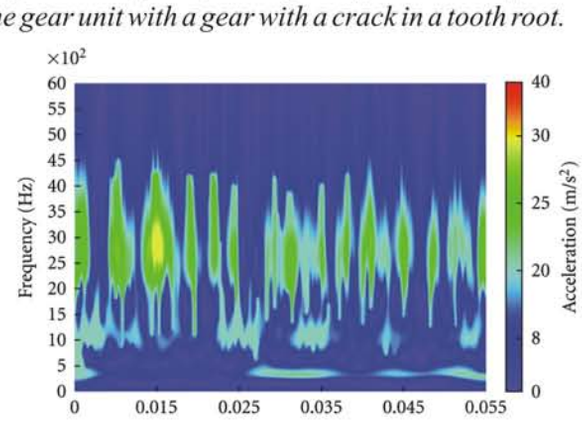

Figure 6: Frequency scalogram of square wavelet coefficient of the gear unit with a gear with a crack in a tooth root.

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To carry out next comparisons, the standard denoising method is used in concern to actual data (Figures 7 and 8) related to practical signal presented. Different thresholds are used for this method. The signal de-noised by means of Stein's Unbiased Risk Estimation (SURE), Hybrid or heuristic SURE, minimax thresholds, and universal threshold, respectively, is presented in Figures 9, 10, 11, and 12. SURE threshold is associated with a quadratic loss function. An estimate of the risk is given for a particular threshold value. Minimizing the risks yields threshold value selection. Hybrid represents a heuristic variant of the SURE threshold. A fixed threshold is applied for minimax, it gives minimax performance for mean square error. The minimax principle is applied in statistics in relation to estimators. It is possible to assimilate the de-noised signal to the estimator of the unknown regression function, therefore, the minimax estimator realizes the minimum of the maximum mean square error for the worst function in a certain set. Signal length and noise standard deviation determine universal threshold.

It is evident from denoising results, after having used four different threshold strategies, that no strategy has presented the original signal with one impulse belonging to the crack in the tooth root. Also other factors have impact upon effectiveness of denoising. These factors include wavelet decomposition level and threshold rescaling method selection.

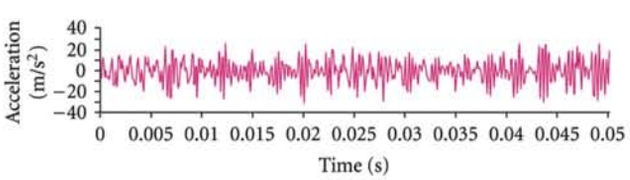

Figure 7: Measured signal of vibrations of a faultless gear unit.

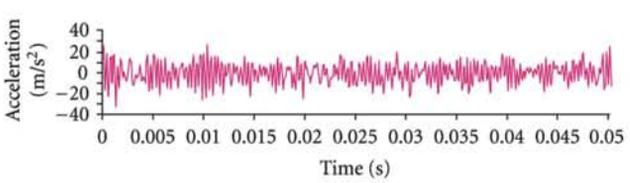

Figure 8:Measured signal of vibrations of a gear with a pinion with a crack.

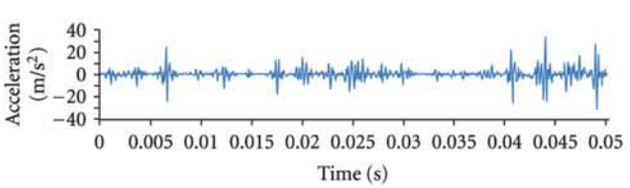

Figure 9: De-noised signal of vibrations of a gear with a pinion with a crack with SURE threshold.

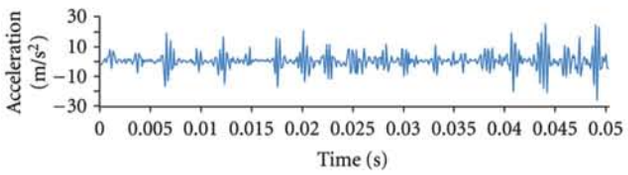

Figure 10: De-noised signal of vibrations of a gear with a pinion with a crack with Hybrid threshold.

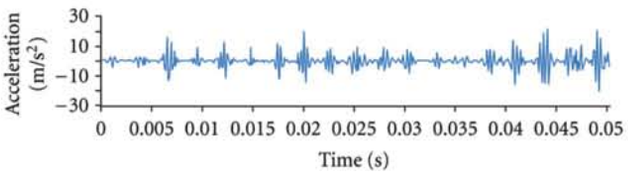

Figure 11: De-noised signal of vibrations of a gear with a pinion with a crack with Minimax threshold.

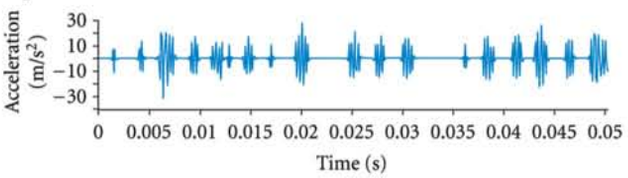

Figure 12: De-noised signal of vibrations of a gear with a pinion with a crack with Universal threshold.

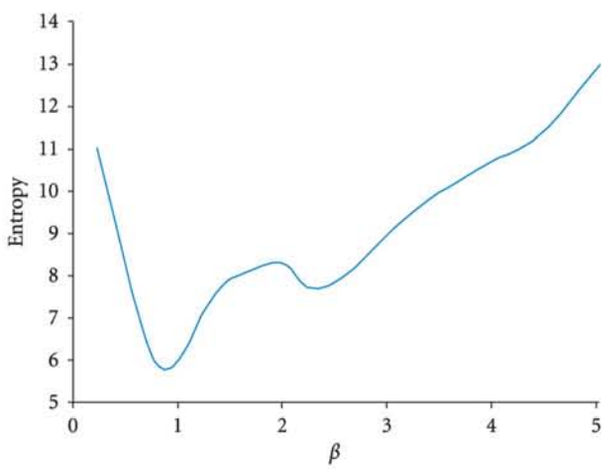

Figure 13: Graph of the parameter β and Renyi Entropy.

4.2. Results Analysis Concerning Practical Signals. Morlet wavelet was used to obtain the adaptive wavelet filter. The graph of the parameter β and Renyi entropy relationship is presented in Figure 13. The entropy is very sensitive to the value β. Let parameter β vary from 0.1 to 5 with a step size of 0.1. The minimal value of Renyi entropy is the optimal selection of β. When β = 0.9, the minimum value of entropy is 5.85, as shown in Figure 13. As a denoising method, the Morlet wavelet is used. Equation (14) with $\alpha = 0.1$ can be used to approximate the impulse probability density function. For each scale, MAD/0.6745 is used as the noise deviation estimator. ForMorlet wavelet, the same parameters are applied as described before. Measured signals of vibrations of a faultless gear and of vibrations

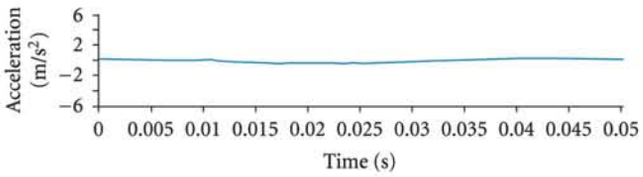

Figure 14: With Morlet wavelet de-noised signal of vibrations of a faultless gear unit.

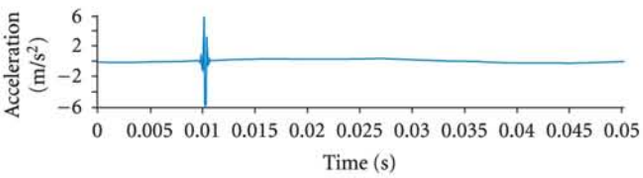

Figure 15: With Morlet wavelet de-noised signal of vibrations of a gear with a pinion with a crack.

of a gear with a crack in the tooth root are presented in Figures 7 and 8. Figure 14 shows denoising signals of a faultless gear. It can be noted that no impulses exist in the signals, whereas Figure 15 shows results of filtering with optimized wavelet filter for signals of a gear with a crack; in these signals it is possible to observe impulses at 11ms also after the noise has been removed.

The signal length is 50ms, representing one rotation of the pinion. 19 teeth are along the circumference. The increased amplitude is located at 11 ms and belongs to the fourth tooth in the direction of rotation from the reference positional point of the gear unit.

5. Conclusion

By means of adaptive wavelet transform it is possible both to define changes and to establish the presence of a damage or fault, at the level of an individual tooth. Adaptive wavelet denoising methods are very useful to determine local changes in gears. Wavelets optimised by means of the Renyi entropy match impulses very well. Consequently, it is possible to define impulses hidden in noise signals by means of the wavelet transform. The maximum likelihood estimation threshold rule and prior information on the probability density function of the signals to be identified are used. On the basis of this method, impulses were extracted from practical engineering signals; the results of this procedure are very reliable.

When it comes to life cycle design, the actual condition of a device and of its vital component parts, which influences the operational capability significantly, can be observed. It is beyond doubt that the reliability of operation control is significantly improved with in-time detection of faults and damages. If faults are detected in a very reliable way, this leads to a better prediction of the remaining life cycle of a gear unit.

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Shri Mandvi Vibhag Sahakari Khand Udyog Mandli Ltd.

Vadod, Dist. Mandvi,
Surat.

The sugar industry in co-operative sector in many states has played a very vital role in development of rural areas and had so far rendered human services to the marginal farmers, landless laborers economically and socially weaker section of the society in the area of social welfare activities, medical services and education and with the same prime object this co-operative society was established in the year as back as in the year 1994 and got registration with Co-operation Dept. of Gujarat Government vide registration No.SE-70 on 25/05/1994, intending to establish its sugar factory so that it could pay an important role in social and economic development of Mandvi Taluka, the interior part of Surat District which is mostly dominated by adivasis. The society has 22849 Nos. of shareholders of which most of them are SC/ST small and marginal farmers as played by neighboring Sugar factories such as Bardoli, Madhi, Chalthan and many others in South Gujarat.

HISTORY

The climatic condition in its command area is conducive for agriculture and particularly for sugarcane crop as an average rain-fall is above 60" to 70" per season and over and above, the canal net-work of Ukai Dam throughout the year provides perennial irrigation. Considering all above, Co-Operative leaders of this area formed this Co-Op. Society with a noble cause of setting up Co-Operative sugar factory in South Gujarat, so that the Adivasi, small and marginal farmers can be benefited by cultivating sugarcane which will subsequently improve their socio economic condition. It will be a great blessing to all cane growers/farmers and also to quite good numbers of youth offering them jobs/ employments.

The suitable size of the sugar factory to be set up considering all aspects such as finance involved, availability of sugarcane being the main raw material and its potential in future, term loan and interest burden, financial viability, climatic conditions, irrigation facility available in command area.

VISION

The basic Vision of the society is to promote agricultural activity by implementing the modern methodology of the same and principles of joint- agriculture so as to

yield benefits to the farmers as well as tenants farmers for the optimum agricultural out put and to realize the same to encourage, economy, co-operation and a sense of self reliance amongst members.

- To acquaint and implement modern methods of agriculture for sugarcane and to provide seeds, fertilizers, tools, insecticides etc. to the members on loan and to provide necessary agriculture related education to members to faster their growth.
- To Construct building / or to acquire the same in any other manner to cultivate sugarcane crop and to erect machinery for the same.
- To construct and run a sugar factory and purchase plant and machinery for the same to raise share capital or to borrow the necessary funds from co-operative societies/ NRI / Private/ Bank / Central Financial Institutions or from any other institutions on mortgage of the moveable and immoveable properties or otherwise.
- To cultivate sugarcane to produce sugar and to purchase sugarcane from outside and other raw material inventories for the factory.
- To do any other incidental acts which are necessary to run the factory or society.
- To provide loans to members for cultivating sugarcane to develop modern method on the security of either sugarcane or sugar and to recover loans out of the sale of sugarcane provided by the members.
- To develop other sugar related industry and to implement machinery for the same, to acquire materials and to make arrangements for its sale or import / export of the same.
- To create model farm for the education of members of the modern methods of agriculture of sugarcane to use improved seeds, to organize seminars, conference etc.

MISSION

Infrastructure Facilities

The Society may have to develop necessary infrastructure facilities, like Hospital, Technical and Agricultural College etc. Power Project, Ethanol Project.

Tribal Dominated

The Co-Operative society's members are mostly tribal's. It is noteworthy to see that it is the only Co-Operative society located in tribal dominated area of Mandvi Taluka. The raw-material i.e. sugarcane is supplied by these tribal grower members. The society is confident to pay the maximum possible cane price to its grower members. The society intends to install a 2500 TCD plant in this region. The proposed factory will produce crystal sugar. It will provide inducement to sugarcane grower to adopt better practices to get more output.

Realization of such attractive returns of their agro products will improve their economic conditions which will again result into increasing their agricultural productivity.

After start up of this cooperative sugar mill the economic conditions of tribal's will improve substantially, since it will help to sell their agricultural produce and provides job opportunity during seasons. Thus the sugar factory acts as a catalyst for improving socio economic conditions of tribal's.

Potential for Cultivating Sugarcane

There are 775 villages falling under the command area of our establishing sugar factory. Part of these villages also falls in command area of nearby sugar factories. Even though if we deduct the area falling under command area of other sugar cooperatives, still there is more than enough area to produce sugarcane. The availability of land and irrigation potential available in the area of proposed sugar cooperative society.

There is a great potential available for growing more sugarcane. In summing up, it can be safely concluded that the society can get sufficient sugarcane for crushing. Due to development of factory, automatically, the living standards of the grower members will improve which justifies the proposal.

Utility of Mechanical Engineering Machinery

No.	Application of Mechanical Engineering Machinery	Machinery Company Make
1	Pump	KSB, Gita, Rotomake
2	Valve	Calsens Pvt. Ltd.
3	Centrifugal Machine	Nhec, Krupp
4	Crane	Sitson India Pvt. Ltd.
5	Gear Box	Top Gear Transmission
6	Pipes	Standard Make
7	Turbine	Triveni
8	Alternator	Kirloskar Make
9	Mill	Thyssenkrupp
10	Boiler	Sitson
11	Process Equipment	Suplied By Sitson India Pvt. Ltd.

Utility of Electrical Engineering Machinery

No.	Application of Electrical Engineering Machinery	Machinery Company Make
1	Motors	Kirloskar Electric Co. Ltd.
2	Wires	Polycab, Finolax
3	MCB	Hpl, Sieman, Standard

Location of the factory

A	**Address of the Registered Office**	**At. Vadod Po. Boudhan Tal; Mandvi, Dist: Surat, Gujarat State.**
B	Distance from district head quarter, Surat.	65 kms
C	Distance from taluka Mandvi	20 Kms
D	District	Surat
E	Nearest Railway station Nearest Airport	KIM (distance from factory 32 kms.) Surat (distance from factory 70 kms.)
F	Distance from state Highway	2.5 Kms

Brief history of plant

Co-operative Society formation and Registration No. and date:

- The registration No. of the Co-operative Society is SE/70 and date of registration is 25.05.1994.
- Industrial Entrepreneur Memorandum (IEM) No. : 2822/SIA/IMD/2008

Need of establishing sugar plant

Agro climatic condition in our establishing sugar factory zone is suitable for cultivation of sugarcane. The area of operation of our establishing sugar mill is located in the potential sugarcane belt of the state. Sugar recovery in the located area varies form 10.00 to 11.00 percent cane and there is further scope to increase the production of sugarcane.

- There is no sugar plant within 15 kms radius of plant.
- The command area is fully irrigated.
- Soil & climatic condition are very conducive for cane cultivation.
- Quality of cane is very good. High recovery up to 11.20% is expected from the area.
- Yield of cane is very good.
- The area is fully free from floods etc.
- The farmers are very keen to supply cane to mill.
- Presently the cane is being supplied to near by sugar mills.
- Plant shall be suitably designed to reduce steam consumption power consumption and hence shall save extra bagasse .
- The Chairman & Managing Director are very well versed with Sugarcane cultivation & working of the mill.

Mill Management :

Shri Babubhai S Badan
(Chairman)

Shri Balubhai Z Gamit
(Vice- Chairman)

Shri Ravindrabhai V Patel
(Managing Director)

D) No .of Directors - 16

E) List of senior officers :

Shri M B Bhagatwala (Accountant)
Shri Dilip P Kulkarni (Adm. Manager)
Shri Madhav S. Patil (Estate Manager)
Shri Madhukar M. Salunkhe (Cane Development Officer)
Shri Hitesh R Chaudhari (Asst. C.D.O)
Shri Shrikant. P. Bhavsar (Chief Chemist)
Shri Mohan. M. Patel (Chief Engineer)

At present working of the society is being looked after by the Chairman and Managing Director.

PRESENT SUGARCANE STATUS AND AGRICULTURAL PRACTICES

The sugar factory zone in the district of Surat has good scope for the cultivation of sugarcane crop. The total cultivated area in the operational area of proposed sugar mill is 1,46,647 hectares and area under sugarcane in Society's command area is about 30000 to 32000 hectares producing 17 to 18 lacs of sugarcane which is being taken away by neighboring sugar factories namely Bardoli, Madhi, Mahuva, Chalthan, Sayan, Vyara and Kamrej. And whereas this Society supplies sugarcane to nearby sugar factories every year to the tune of 40000 to 50000 tones though the Society is not having its own Sugar factory.

The area of operation of the Mandvi sugar unit is located in one of the potential belts of sugarcane crop in the State of Gujarat. The agro-climatic conditions that the proposed site of sugar mill at Village Vadod, Taluka Mandvi has good scope for the cultivation of sugarcane crop.

SUGAR PLANT

Gujarat state is endowed with tradition of cane growing area in our country and sugarcane is available in abundance in the state. The government of Gujarat encourages various sector co-operative sector being the prime one for attaining the maximum advantage by setting-plants for manufacture of sugar and allied products; besides co-generation of power for captive consumption as well as for other purposes. Co-operative Societies under the aegis of a number of prominent personalities in the society, are quite eager to offer their contribution towards this direction.

Shri Mandvi Vibhag Sahakari Khand Udyog Mandli Limited, At. Vadod Po. Boudhan Tal; Mandvi, Dist: Surat is a prominent co-operative society based organization in the state of Gujarat.

The Karkhana, with the support of its members intends to venture into setting up a unit comprising of a sugar plant of 2500 TCD capacity for manufacture of sugar.

PROMOTERS / MANAGEMENT

Board of Director : The Karkhana has the following Directors in its Board, all of them are well experienced in sugar industry and have the necessary entrepreneur skills and capabilities to successfully implement and run the unit.

Brief profile of the Directors is as under :

Name of the Director	Current Position	Profile
Shri Babubai S. Badan	Chairman	Agriculturist and management expert
Shri Balubhai Z. Gamit	Vice Chairman	Agriculturist and management expert
Shri Ravindrabhai V. Patel	Managing Director	Expert in operation of sugar industries.

Other Key Personnel : The promoters proposes to establish the sugar factory which will be managed by a dedicated team of well-qualified professionals, technical and management personnel. The company proposes to utilise the services of some of these personnel in implementation and establishment of the proposed project. The main in-charge of the execution and implementation will be Shri Ravindrabhai V. Patel, in the capacity of Managing Director.

MANAGEMENT & ORGANISATION

The management of the company is divided as under :

Policy matters : The Chairman supported by well constituted board of directors is responsible for all the key issues and policy decision of the company. The board is also assisted by technical, financial and other production related professionals employed, by providing appropriate counseling through frequent meetings and feed-back. Shri Ravindrabhai M. Patel, the Managing Director, will be in charge for commissioning of the entire project and thereafter commencement and overall supervision of the day-to-day activities.

Sale & Production Department : The Sale department will have the responsibility of marketing the product. The production team will look after overall manufacturing process and will consist of Engineers, Chemists and other Executives to carry out the process with the help of the support staff.

SHARE CAPITAL

Shri Mandvi Vibhag Sahakari Khand Udyog Mandli Limited,is a co-operative society formed primarily by agriculturists and sugarcane growers. The society is having around 32000 shareholders and the majority of the shareholders belong to scheduled tribe. The Society have accumulated a share capital of Rs. 800.00 lakhs, and utilizing for project under construction.

FINANCIALS OF THE COMPANY

Shri Mandvi Vibhag Sahakari Khand Udyog Mandli Limited, was largely dormant awaiting implementation of the sugar manufacturing plant. All the necessary permissions/approvals and licenses for establishing and running the sugar plant have been obtained from the concerned authorities. Further, as a preliminary measure, the promoters have already acquired a piece of land at vadod location.

CURRENT PROJECT STATUS

The basic approval for land use and other permissions has been obtained. All relevant statutory clearances are obtained. The Project is on turnkey basis.Total order for sugar plant machinery is placed with M/S Soston India Pvt.Ltd Domabivali,Mumbai. All the civil foundations & R.C.C Chimney work already finished. Civil work of E.T.P Plant is about to complete. Erection of factory building shed is already completed. Erection of Mills, Boiler, Power Turbine, Process equipments are in progress, The Project will start the sugar production By October 2014.

PROCESS & TECHNOLOGY

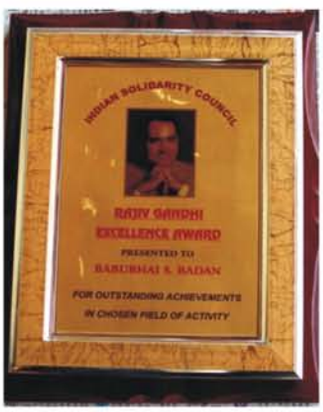
The company is setting up a unit for manufacturing sugar with capacity of 2500 TCD. The process involved in sugar manufacturing is of latest technology.

The Mandvi Sugar is installing a sophisticated Effluent Treatment Plant with the latest technology for ensuring eco-friendly operations of the proposed project.

BIO-DATA

Name of Chairman	:-	Shri Babubhai S. Badan
Qualification	:-	S.S.C
Occupation	:-	Farmer/ Social worker
Experience	:-	Last 21 years in Co-operative Sector.
Name of Vice Chairman	:-	Shri Balubhai Z. Gamit
Qualification	:-	S.S.C
Occupation	:-	Ret.Depy.Mamlatdar/ Farmer/ Social worker
Experience	:-	1) Retired Mamlatdar in State Government 2) Executive Director in Torrent Power Ltd.
Name of Managing Director	:-	Shri Ravindrabhai V. Patel
Qualification	:-	B.Com/M.S.W/L.L.B
Occupation	:-	Service/Farmer/ Social worker
Experience	:-	Last 28 years in Co-operative Sugar factory on Managerial level.
Name of Chief Accountant	:-	Shri Manharlal B. Bhagatwala
Qualification	:-	B.Com
Occupation	:-	Service
Experience	:-	Last 37 years in Co-operative Sugar factory.
Name of Administrative Manager	:-	Shri Dilip P. Kulkarni
Qualification	:-	M.Com (Hons.)
Occupation	:-	Service
Experience	:-	Last 38 years in Co-operative Sugar factory.
Name of Chief Engineer	:-	Shri Mohan .M. Patel
Qualification	:-	Diploma in Mech. Engin./ Boiler Proficiency Engi.
Occupation	:-	Service as Chief Engineer
Experience	:-	Last 32 years in Co-operative Sugar factory.
Name of Chief Chemist	:-	Shri Shrikant .B. Bhavsar
Qualification	:-	B.Sc (Chemistry)/Post Graduate Diploma in"Sugar Technology"
Occupation	:-	Service as Chief Chemist.
Experience	:-	Last 26 years in Co-operative Sugar factory.
Name of Estate Manager	:-	Shri Madhav S. Patil
Qualification	:-	B.Sc Agri
Occupation	:-	Service as Estate Manager
Experience	:-	Last 30 years experience as a Agri. Officer, C.D.O and Estate Manager in Co-operative Sugar factory.
Name of Cane Development Officer	:-	Shri Madhukar M. Salunkhe
Qualification	:-	B.Sc Agri / G.D.C.K.A
Occupation	:-	Service as C.D.O
Experience	:-	Last 35 years as C.D.O and Chief Agri Officer in Co-operative Sugar factory.

AWARDS & RECOGNITION



INDEX

The Deccan Sugar Technologists' Association [INDIA]

॥ शर्करा शोधनं ज्ञानसंवर्धनम् ॥

The Deccan Sugar Technologists' Association (DSTA), Pune [India] was established in the year 1936 under able guidance of Seth Lalchand Hirachand, who was closely associated with Sugar Industry. In those days, machinery for sugar plants used to be imported and it was a great task to understand and operate the sugar plant and machinery. The farming practices of Sugar Cane cultivations were also in the development stage.

It was necessary to have an interaction between the Agronomists, Sugar Technologists' and Sugar Engineers of various operating sugar factories. Training to technical staff was also necessary. To undertake these activities, a common platform was rendered by D.S.T.A. covering the states of Maharashtra, Gujarat and Karnataka.

Initially, the technical discussions on various subjects used to be conducted at the sugar factory level. Further, a forum was formed by way of submitting the technical papers on observations and research at factory level. The live discussions on papers, concluding the gist of papers was also started. It was felt necessary to have an office at a central place, hence Pune being central place, the office of the association was set up in Pune in the year 1967 and the annual conventions were being conducted in Pune.

The association has been ably supported by stalwarts from the Sugar Industry; namely Shri. D. M. Dahanukar, Seth Gulabchand, Shri. M. L. Apte, Shri. H. B. Girame, Shri. V. S. Shirgaokar, Shri. K. J. Somaiya, Dr. Shantilal Somaiya and others. From the year 1953/54, the co-operative sugar factories and the prominent leadership from Co-operative Sector like Shri. Vasantdada Patil, Shri. Ratnappanna Kumbhar, Shri. Tatyasaheb Kore, Shri. Baburaoji Tanpure, Shri. Shankaraoji Mohite Patil, Shri. Kakasaheb Wagh, Shri. Vitthalrao Vikhe Patil, Shri. Yashwantraoji Mohite, Shri. Balasaheb Vikhe Patil, Shri. Shankarraoji Kale, Shri. Shankarraoji Kolhe, Shri. Shivajirao G. Patil, Shri. P. K. Anna Patil, Shri. Jayantraoji Patil, Dr. Dahyabhai Patel, Hon'ble Shri. Sharadraoji Pawar and many others have actively supported the Association.

The strength of the association is in its membership which includes the 'Patrons' [The Stalwarts], 'Companions' [Sugar factories, Machinery Manufacturers], 'Life members' and 'Associate Members'. At individual level, the membership was represented by Shri. J. P. Mukherjee, Shri. S. N. Gundurao, Shri. G. R. Mahajan, Shri. G. K. Zende, Shri. G. K. Patwardhan, Dr. D. G. Dakshindas, Shri. K. H. Parikh, Shri. B. L. Chakradeo, Shri. H. R. Arakeri, Shri. N. C. Kharkar, Shri. J. H. Huja, Shri. Mangalsingh, Shri. S. V. Arbatti and many others by way of submitting the technical/research papers at the annual conventions. Some of the papers have been acknowledged at International Sugar Conferences. The rich collection of all technical papers discussed and published in seminars and annual conventions is available with the office of the association.

Day to day activities of the association are being controlled with the help of Mr.B.V.Shinde, MLA, - President, Mr. R.V. Shirgaokar Ex-Vice President, Mr. Mansingrao Jadhav Vice President, Mr. S.S. Gangavati Vice President (Tech), Mr. PNR Rao Treasurer, Mr.R.S. Ranaware Hon. Secretary and Mr. A.S. Ashtekar Executive Secretary.

Today, the association is housed in a six storey ultra-modern facility. This building was inaugurated on 2nd July, 2011 at the hands of Hon. Shri. Sharadraoji Pawar Minister for Agriculture, Govt. of India, New Delhi. The building also houses an auditorium of 180 seats, conference rooms, laboratory, training centre, etc. Training programs are regularly being conducted to help sugar factories.

Proavtive Leaders

Shri Babanrao Vitthalrao Shinde (MLA)
- President DSTA

Shri Babanrao Vitthalrao Shinde (MLA) President, Deccan Sugar Technologists' Association Chairman, Vitthalrao Shinde SSK Ltd., Gangamainagar Post: Pimpalner, Tal: Madha, Solapur 413 210.

Shri. B. V. Shinde has been the President of DSTA since 2003. He was Leader of Zilla Parishad, Solapur from 1982-1985, President of Solapur District Co-operative Milk Union from 1990-1997 and since 1995, continuously 4 terms of 5 years each, he is Member of Maharashtra Legislative Assembly from Madha Constituency. He is a President of Madheshwari Urban Co-op. Bank Ltd., Madha from 1998, Vice President of Sugar Technologists Association of India, New Delhi from 2003 and Founder Chairman of Vitthalrao Shinde SSK Ltd., Madha and Vitthal Shikshan Prasarak Mandal, Nimgaon, Tal: Madha.

He has initialized following developments :

1. Bhima-Seena River Link Tunnel due to which 11800 hectors of land get irrigated. Longer ever in Asia i.e.22 K.M.Long of Rs. 350 Crores expenditure.
2. Seena-Madha Lift Irrigation Scheme of Rs.300 Crores capital expenditure due to which 10000 hectors land came under irrigation.
3. Industrial Training Institute at Kurduwadi.
4. Arts College at Tembhurni and Science College at Kurduwadi & English Medium School at Pimpalner.
5. Milk Chilling Plant at Tembhurni (Co-operative Milk Union)
6. M.I.D.C. at Tembhurni and Kurduwadi.
7. Cattle camps in scarcity period-During the severe drought in 2012-13 the Karkhana run 50 Cattle feeds and reared 35000 Cattles by providing cattle feed, water and medicine.

Shri. Mansingrao Jaysingrao Jadhav
- Vice-President DSTA

Shri. Mansingrao Jaysingrao Jadhav is a Patron member of DSTA and then after served as Vice President(Tech) for 8-10 years and is now Vice President of DSTA since 2012.

Shri. Jadhav joined Warana SSK Ltd. as a Lab chemist and then became Chief Chemist at Rajarambapu SSK Ltd., Sakharale. He was selected in MDs panel in 1974 and joined Shriram SSK Ltd., Phaltan as MD. Then he worked as M.D. at Niphad SSK for 5 years from where he was offered the position of General Manager in East African Sugar Industry at Muhoroni, Kenya. The factory managed by Mehta Group of Industries, a group run by Mr. Mahendrabhai Mehta's family. While serving in Kenya, he was honoured by Kenyan Government to look into sugar related matters for Kenyan Government.

In 1987 he returned to India and joined as MD of Vasantdada SSSK Ltd., Sangli, While working as MD, he formed 'Managing Directors Association' of Maharashtra Sugar Factories. This was an organisation working for the welfare of Sugar industry as well as MDs working with it.

After leaving Vasantdada SSSK Ltd., Ltd., Sangli, he joined with consultancy firm which was already formed by Shri. Avdhoot Joshi and Shri. Jadhav. They completed 2 projects in Nepal and one at Athani, in Karnataka.

While working with Mehta group of industries at Kenya, Mr. Jadhav, along with his 3 friends, Shri. Joshi, Shri. Pawar and Shri.Deshpande, formed a group called Marvelous Group of Industries. This group started its activity with cast iron foundry, called as Marvelous Metals at Gokul Shirgaon, MIDC. After establishing it, a workshop was started along with Shri. Sangram Patil, an addition to the group. This also worked well giving birth to a new unit, in collaboration with an Italian partner, called as 'Marvelous Machinist'.

Shri. Jadhav has also been a Technical director on board of Ravalgaon Sugar Factory, for about 12-15 years and the technical director at Ajara SSK Ltd. for couple of years.

For his extensive expertise in co-operative management, Shri. Jadhav was awarded the Fie Foundation award for Excellence in Management in 1995.

Shri. Shripad S. Gangavati
Vice-President
(Technical) DSTA

Shri S.S. Gangavati is a Patron member of DSTA and a Life member of Sugar Technologist's Association (STAI) and is now Vice President (Technical) of DSTA since 2012.

Shri. Gangavati started his career with Walchandnagar Industries Ltd. Pune in 1967 as Chief of Engineering ending with Head of Strategic Planning and Market Research, and now works as an Advisor to Walchandnagar Industries Ltd. As the Head of International Division, he has travelled more than 50 countries Europe, USA, South America, Carebbian, South East Asia, Far East. He was posted for extended periods in Indonesia, Tanzania, Malaysia, Kenya, Nigeria, etc.

He has published and presented a total of 17 technical at nationaland international forums and has been awarded a patent for 4 cases of R&D work.

He is Patron member of DSTA and Life member of Sugar Technologist's Association (STAI), South India Sugar Technologists Association of India (SISTA), and Bombay Management Association. He has also served as former Chairman of Confederation of Indian Industry (CII) Sugar Machinery Division and Member of International Sugar Technologists Association.

Shri. Gangavati is the recipient of the prestigious 'Life Time Achievement Award' of STAI.

Lending Technical Expertise to Sugar Co-Operatives across the country

"The challenge is to keep on positive work till you achieve your desired goal"

Mr. G. D. Patil Managing Director at Sahakari Khand Udyog Mandali Ltd. (SKUML) Gandevi.

When we say "were there is will there is a way" we surely might not have realized that a Son of a Primary school teacher of a small village situated in the industrial state of Maharastra Mr. G.D.Patil Will prove the worth of every single word with his proactive thinking and the pragmatic guidance of his father. Mr.Patil says "it was my father's support, energy and guidance which brought me out of all the mental stress that I had and the guidance and education he provided me is still helping me take decisions firmly and live life strongly"

Presently working as the managing director at Sahakari Khand Udyog Mandali Ltd. (SKUML) Gandevi. Mr. G.D.Patil was Born on 1st Sept 1954 in a small village Brahamanpuri situated in the Shahada tahasil & Nandurbar District, North west Maharashtra. As far as the economical condition of the family is concerned Mr. Patil's father had a small land for farming apart from the teaching job.

Perseverance, imagination and courage sustained his transformation. His family nurtured his independence and high spirit; however, many of his strengths were born out of struggles. In order to prove his ability to get the admission in the Govt Public School he had to give an Competitive Exam and it was to his industrious efforts that he stood on the 12th position through out the state in that competitive exam and based on merit got selected and admitted to Govt public school which was opened by Maharashtra Govt for the students of rural area villages whose population was less then 10,000.

Mr Patil's own challenges did not stop with his selection in the Govt Public School . Though known for his genuine efforts and hard work, Mr.Patil, has also seen his share of calamities in both personal and professional life.

Mr.Patil took lessons from those experiences, but was never unnerved. In many cases, his failures led to innovation and greater success. In his early student life, he continually experienced cash-flow problems. "I never concentrated on the money problem and I think that was the most persuasive incentive I've ever had," say's Mr. Patil.

He completed his Secondary education from Govt public school Nasik and passed SSC with Distinction from SSC Board Pune.

Mr. Patil remembers the teachings imparted by his parents and adds "My parents had always told me that all you have in life is hard work with sincere efforts towards achievement of goal" he then realized there were some rules he would heed in the future. "I vowed to myself that I would work hard, prepare for my exams systematically and will not concentrate anywhere else." He then got admitted in the Elphiston College Mumbai in science and earned his first class bachelors degree in science from Pune University.

Through-out the education he enjoyed the scholarship of Rs 100/- per month from the Govt of Maharashtra and completed sugar Technology Degree from National Sugar

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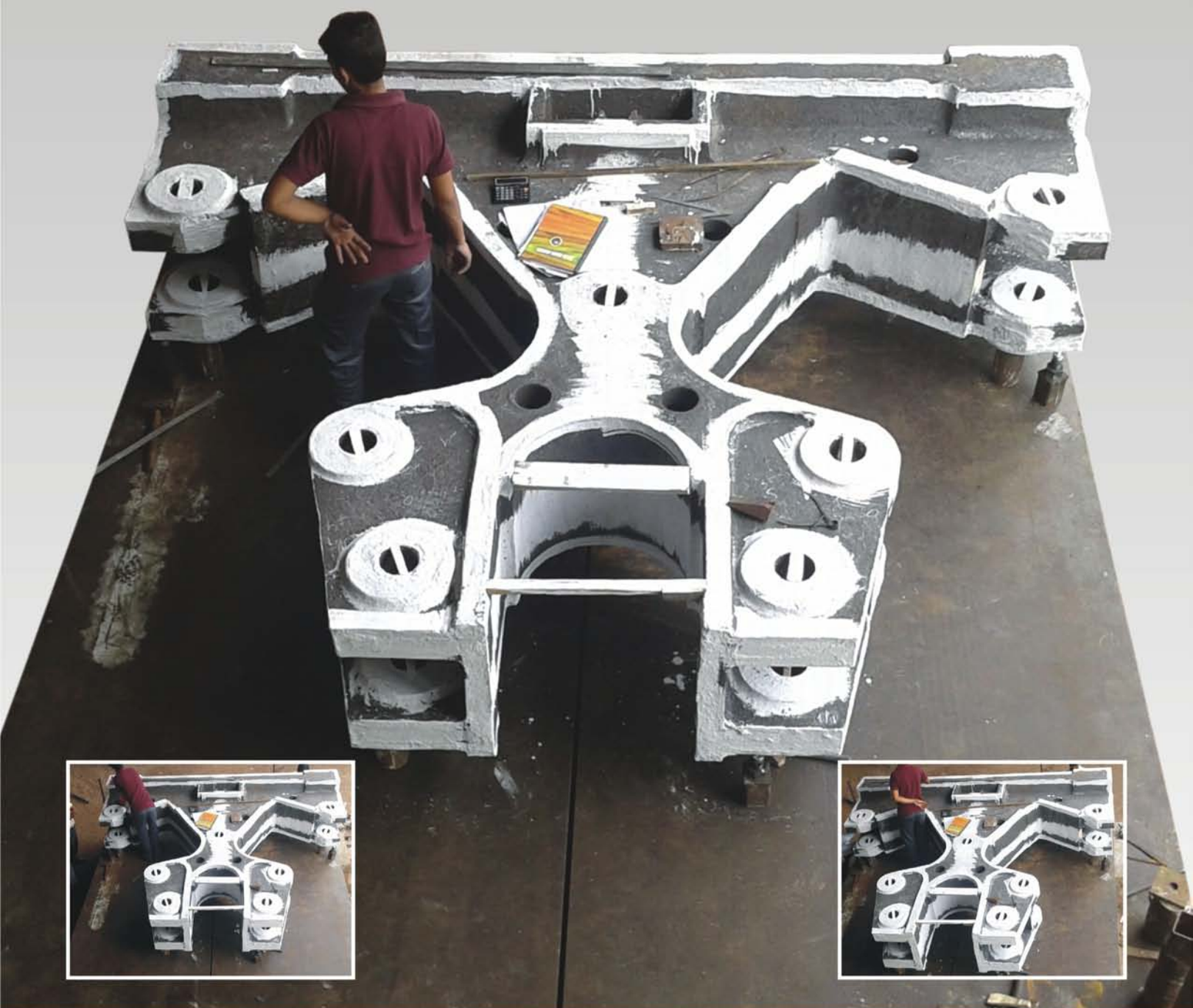

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full potential in every aspect of my future professional carrier. My ultimate goal is to be a proactive professional and a better human being Says Mr. Mehta.

Mr. Mehta adds - We as professional must be autonomous. Nobody else can tell us what to do; we ourselves are responsible for maintaining professional standards and should be committed to those standards. We must be aware of our responsibility towards our plant and their learning. We shouldn't just purchase different machinery or repair them, we must also learn, continually – about our subject matter, about the modern maintenance methods, and about many other things that make us better Plant Engineers.

"Leaders go first. They set an example and build commitment through simple, daily acts that create progress and momentum. Leaders model the way through personal example and dedicated execution"

We frequently came across in fact ordinary managers doing pretty extraordinary things as leaders and producing outstanding results with their teams. Managerial perception most likely begins with the recognition that there is no one "right" style of leading and managing. But the new standard manager is mostly acting in the role of transformational leader.

If the leader's professional creditability is to remain the crucial source of authority. Creditability, in turn, in the role of a leader, goes beyond professional reliability and competence. Mr. Mehta as a Leader is doing what is correct for the situation and the people involved in it.

Today's market is competitive and volatile. To be successful, one needs to be dynamic and ahead of competitors. In order to accomplish this, one need strong leaders within every business unit driving innovation and efficiency. Having leaders with focus, motivation, and the ability to drive change throughout the workplace will allow to accomplish goals.

Mr. Mehta as a leader has an ability to coach to those who work with him. He will find that they will work better and will respond better as compare to before coaching.

Mr. Mehta revels - I am thankful to My wife Rekha & my ex. boss Mr. Girdhar Balwani from the bottom of my heart, they helped me, guided me and supported me at very crucial moments of life and I am sure had it not been to their love and support I would not have been at the position I am today.

As in the honorable world, coaching is a good way for helping people to improve their talent and achieve their goal with full potential. Successful coaching by leader gives many more benefits, it's not the financial result which you invested in your training or coaching but also the productivity increases after this coaching, and ability of consideration decisions rises and as well the motivation or inspiration increases. And when leader time to time give training or coach to his employees, leader becomes aware of his employee's nature and it makes easy to communicate more sincerely and more easily.- Says Mr. Mehta.

The development is competence in our professional responsibility, and it is a long-term and ongoing process. Mr. Mehta revels- In the early years of my career I was basically concerned with what to do, and I didn't notice or think about other aspects . Then I started noticing other engineers' behavior and the needs of the plant, and I started reflecting on my own practices, exploring how to, and why to act as per set norms in each particular context in a way that I could contribute to make the plant performance better . I discovered that my contributions could really contribute to my plants' transformation, and that I as a engineer must bear with the shaping and reshaping of the desired learning outcome of my plant.

Then a sense of commitment towards my profession started to develop, and I discovered that I still lack some of the conditions a professional must have, and that the limitations in my cognitive framework constrain my practices – says Mr. Mehta

Mr. Mehta revels -I've come to a point in which I wish to stop playing around, experimenting in an irresponsible and irregular way. I want to be able to take courses of action that are based on knowledge and thought, rather than on curiosity and creativity. I know now that it is necessary to understand the principles underlying both automatic and consciously designed action. I now understand that I must base my professional action on the results of academic research and theorizing , as well as my personal experiences. I feel the need to use successful pedagogical techniques that might bring new insight and more innovative possibilities to my practice, because I believe that skills without knowledge or principles are professionally unacceptable and the knowledgeable engineer who is also skillful is a powerful educator.

Work is the most important factor in people's life, it affects on their whole life. In work place, every employer or employee try to do the best, therefore employers tend to challenge each other which can be a source of stress. "This source is known as the interaction between individuals and

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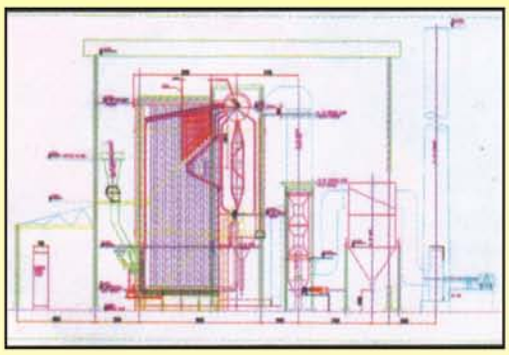

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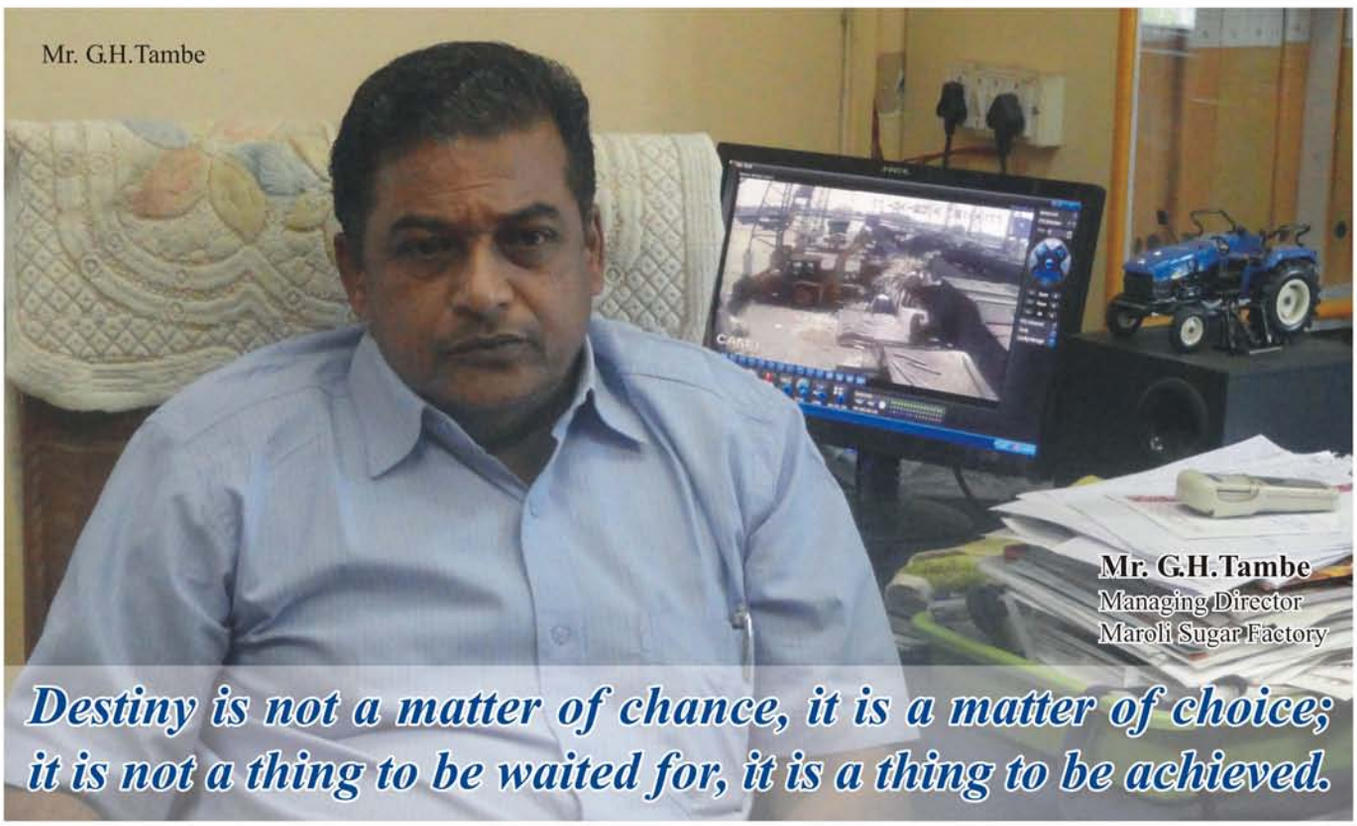

Mr. G.H.Tambe a 1st class Mechanical Diploma holder, started his career at Padmshri Dr. Vithalrao Vikhe Patil SahaKari Sugar Facoty, Pravaranagar Maharastra, as senior Engineer in 1984. considering his work ability and sincerity he was promoted as Deputy Chief Engineer and after gaining a mammoth experience of 22 year in single unit he successfully achieved the post of Joint Managing Director in the year 2013. In the same year he took charge as Managing director in Maroli sugar Factory Gujarat. Mr. G.H.Tambe posses additional qualification in sugar Engineering owning commands in Engineering, Process and administrator of sugar Factory.

Mr. G.H.Tambe says - A good leader is passionate about his work or cause and also about his role as a leader. People respond more openly to a person of passion and dedication. Leaders need to be able to be a source of inspiration, and be a motivator towards the required action or cause. Although the responsibilities and roles of a leader may be different, the leader needs to be seen to be part of the team working towards the goal. This kind of leader will not be afraid to roll up their sleeves and get dirty. Leaders who build passionate teams really appreciate their people, not just their employees. People don't care how much you know until they know how much you care. It is easy to appreciate the top performers who bail you out of tight spots. However, it is more challenging, but more meaningful, to appreciate everyone on your team regardless of their relative contributions.

Hard work and persistence are the magical words that lead to success and fame. Several experiences have stimulated his attraction to sugar world. The first step towards his passion to study sugar industry was formed when he was in school. His hardship in 1984 has propelled him to the success that he have today. His down to earth and humbleness makes it easier for him to cooperate with employees. He normally doesn't give many press interviews and prefer to keep in private life. His low key attitudes still grab media attention as he is passionate about charity and conduct his charity work regularly.

Mr. G.H.Tambe says -There's no secret for success, we all are human beings created by god but the difference is in one's way of getting mature. He believes that anyone can be successful if one really work hard for it. It may take some time. There is no short cut for success.

The constant innovative approach and technical guidance provided by Mr. G.H.Tambe has merged a so called sick unit into the thread of best sugar factories of Gujarat. Operational process of Maroli Sugar Mill, Power Generation and Administration are the key areas where he made proactive and pragmatic changes which yielded Maroli sugar factory a good name in the market.

Owning a Positive attitude makes wonders for you in both personal and professional life, Mr. G.H.Tambe shares one of his such attitude which is positive and constructive in nature.

"I used to works as if there is no tomorrow. i would ask for help from the other people when I was unable to do it. I went through the hard way but that is the right way. I was nothing at the beginning however I was determined that i will learn what i does not know, ask help from the others. I does not feel ashamed for that because I am not stealing."

He has shown a great determination clearly admirable especially to the younger generation, that when we put our

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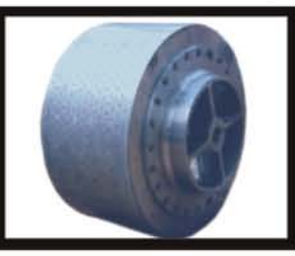

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mind to it, we can achieve anything

Mr. G.H.Tambe knows his own strengths and weaknesses. He adds - The attitude of being lazy and shame should be changed. He thinks that a person has to be patience and put more effort in order to run a business successfully. He keeps on searching for opportunities so that he can keep on helping the others to excel. He is not doing this solely for himself but for everyone. For him, God will only help those who are willing to work hard. Determination, hard work and never give up easily are his keys in achieving success.

In a nutshell, everybody have an equal chance to be successful. Nothing can stop us from being successful unless it is you. If you want to achieve something, you have to work for it.

Mr. G.H.Tambe is a creative innovator that leads him to be a successful Managing Director. He think out of the box and try on new things. He is never been stopped by new challenges. For him, expose himself in new environment and new things is great. He is good in applying the knowledge that he learned in university and in real life. Managing a sugar factory systematically may not be a simple thing as everyone has different point of views & opinions. It is even hard to please all people's need. However Mr. G.H.Tambe sees this as a challenge in life and tries his best to satisfy everyone.

Mr. G.H.Tambe also practice good attitude in life. He is a positive, hardworking and sensitive person. "As a young man, I thought there was no substitute for hard work and thinking up good, honest plans and, without respite, pushing them along." Is the only mantra for success says Mr. G.H.Tambe.

Be humble; be straight; don't be crooked; don't take advantage of people. To be a successful Managing Director, I think you really need to brush all your senses every morning, just as you brush your teeth. your vision, hearing, sense of smell, touch and taste. All these senses come in very useful.

In order to lead and set direction a leader needs to appear confident as a person. Such a person inspires confidence in others and draws out the trust and best efforts of the team to complete the task well. Mr. G.H.Tambe is a leader who conveys confidence towards the proposed objective, inspires the best effort from team members. "When we're confident, we will spend more time doing and very little time worrying about what we do. It's not that we shouldn't think. We should seek data from multiple sources, reflect on options, and make thoughtful decisions. Those are good action steps." Says Mr. G.H.Tambe.

Our Attitude determines our life. Most people are capable, but don't possess the drive to tap into their undeveloped potential. The drive comes from knowing that you can do it because you have a positive attitude. Reveals Mr. G.H.Tambe. "Our environment is a mirror of our mental attitude. If we don't like what we see, we have to change our way of thinking before we can change anything else. Actions trigger feelings, just as feelings trigger attitudes. Try to find good and exciting aspects of anything that may annoy or anger us. Life is dull and irritating only to those who are dull and negative. When we can find something interesting in everything we see and everyone we meet ,life becomes interesting and our attitude will improve. A person must look, act and feel successful before they achieve success"

Under his leadership the Maroli sugar factory took proactive decisions, and several other measures to upgrade the technical efficiency of the unit. Being innovative in nature and a nonstop hard worker Mr. G.H.Tambe tried his best and achieved extra revenue by selling 'Bagasse'. He further explains -Yet there is scope for further improvement which is under consideration and planning to attend ensuing off season.

Mr. G.H.Tambe says - Being a Good leader is tolerant of ambiguity and remain calm, composed and steadfast to the main purpose. Storms, emotions, and crises come and go and a leader takes these as part of the journey and keeps a cool head. He is able to take and tolerate risk, change projects that involve a lot of risk. People who have been successful project leaders for traditional projects may be unable to change their behavior and take the risk of stepping into uncharted waters. Instead they may, perhaps unconsciously, turn away from risk-bearing activities. In doing so they may turn away from potential opportunities, and condemn the project to failure.

It's not the role of a Managing Director to carry out all the changes, but to make sure the changes occur. Mr. G.H.Tambe have always find it easy to find the right balance between leadership and involvement in details.

Mr. G.H.Tambe shares that "A good leader keeping the main goal in focus is able to think critically. Not only does a good leader view a situation as a whole, but is able to break it down into sub parts for closer inspection. Not only is the goal in view but a good leader can break it down into manageable steps and make progress towards it.

"Second best does not lead to success." says Mr. G.H.Tambe. As Managing Director of Maroli sugar factory he is committed to excellence. He not only maintains high standards, but is proactive in raising the bar in order to achieve excellence in all areas.

If he wants to accomplish something productive towards the Maroli sugar factory, willingly, he work hard and to go the extra mile with his potential, enthusiasm, commitment, pride and self-discipline, he have a burning desire to succeed and willing to do whatever it takes to get the job done.

He concentrates on main goals and objectives. He don't get sidetracked .He don't procrastinate. He work on the projects that are important, and don't allow those projects to sit until the last minute. He is productive, not just busy. He have the skills, talents, and training that are needed in order to be successful.

As an experienced professional he knows the things he need to know to be successful. And when he need information, knowledge, or skills and talents that he don't possess, he find someone who does possess them.

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Mr. P.N. Gujarathiwani Face to Face with Mr. P.J. Mistry

1. Tell me something about yourself ?

I am P.J. Mistry; from Umarsadi Machhiwad Valsad. I did my science graduation from south Gujarat University in the year 1980 and I got 1st rank in my favorite subject. Basically I like chemistry and as there was wide scope of sugar industries in those days I decided to work and to become Head of department ie. Chief Chemist in sugar industry. Valsad in my home town and I joined Valsad sugar as Trainee laboratory chemist with no payment or salary. After getting experience in sugar process department and laboratory calculation etc. I decided to do sugar technologist course at Pune and management sponsored the sugar technologist course and I completed ADSI from pune. After that I was working as full-fledge manufacturing chemist in sugar factory and thus I achieved my 1st Goal . The next goal was "chief chemist" and after getting through knowledge of process and administration of process department. I was lucky to work as chief chemist At present I am working in Maroli sugar as "chief chemist."

2. What are your biggest strengths ?

I am very sound in basic sugar manufacturing process. I can also design the process equipments. these qualities help me to select right equipments for the process while addition alternation of process equipment. My knowledge, experience and skill to handle team are the tools for me to become successful chief chemist.

3. What are your career goals as a Chief Chemist ?

As a chief chemist my carrier goals are very clear you know there is demand of highly skilled, Highly educated person in this field and management is expecting maximum work extraction, economy and full fledge result performance and the one who bear these qualities and is devoted to job is only the proper head of department in the field.

My biggest goal as a chief chemist to produce best quality sugar with minimum losses in

process. Also to reduce & to control steam demand in the process causing saving in fuel which will be additional revenue for factory.

4. What is your greatest weakness ?

I am perfectionist and hence I always see day to day working of my department i.e from smallest minor problem to decision making policies in the interest of society, I do not rely upon my assistants though I have trained them and am going to trained them further also, this is my weakness which is only due to my nature of perfectionist.

I am also same what irregular to attend duty in time due to over working in night during season.

I Should attend my duties in time and I will improve the same.

I also think to develop team work but due to nature of some person i.e. not to co-operate, I became very angry which is also my weakness.

5. What do you do to improve your knowledge ?

I have habit to read technical papers and attend Technical seminars to improve my knowledge. There is also an another way and that is to discuss about latest technology with experts in this field and with collogue.

I have the nature to go in deep of any technical problem which ultimately improves my knowledge. Management always encourage me in the matter and this is also one of the reasons to improve myself & my knowledge.

6. What is the importance of CHEMICALS in the sugar mill?

In sugar process chemicals play vital role. To remove non sugar, to improve colour of sugar grain and also to maintain shape of sugar crystal uniform. To minimize the losses in the process chemicals are play important role, Chemical also helpful to minimize scale in heat exchangers and ultimately its minimize the cleaning day in the season.

7. Do you think bio-chemicals can give better or equal results to the present chemicals in processing sugar?

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8. What is the most difficult area of Maintaining Quality of sugar according to you?

In my opinion Juice clarification section is very important. It is the heart of process. I always concentrate on this section as the white bright sparking sugar crystal depend upon clarity of juice. It is my pleasure to state that we always got premium price of sugar in the market.

9. Please share any incident which required immediate attention?

There should not be fluctuation in vacuum of quad bodies & pan. The process is under vacuum in these equipments.

The rise in temperature of Inj. Water is due to non working of spray pump and cause disturbance in manufacturing quality sugar and both require immediate attention to improve working.

We are having short retention clarifier which also require to maintain desire parameters like temp. foculetant doses and withdrawal of mud. The disturbances needs immediate attention to reset the working of clarifier.

10. How do you manage stress during work.?

Whenever I am at stress I sit down under a tree and observe mother nature. I close my eyes and try to relax by breathing normal.

11. Would you like to thank any one, who have helped you and shown you the right path during your hard times?

I am in sugar line since 1983. During the tenure of the service period no of time I observed hard time in service and I thankful to my friend Mr. P. N. Gujarathiwani also our Chairman Shri. Mr. Pravinbhai Thakor who helped me lot of during my hard days.

12. We request you to please share some TIPS ABOUT HOW TO SELECT THE RIGHT CHEMICAL AND THE RIGHT CHEMICAL PROCESS with our readers?

There are number of tips but one tip I may share with reader. i.e. use of lime. We prepare milk of lime and use the same for process. There are Burnt Lime and hydrated lime available in market.

The Burnt Lime consist grit. Which is being separated, sugar industries purchase one tone basis. In my opinion we should purchase Hydrated lime on minimum suitable consumption per ton of cane basis, which effects quality supply and also reduce purchasing cost.

We should select proper result oriented chemicals for Mill sanitation, which reduce bacteria formation and ultimately to restrict the decoration of sugar.

13. Your tips to maintain high quality of sugar?

For a best clarification of juice parameters like PH, Temperature and retention, continuous monitoring is required, to achieve transparent Juice clarity for better quality of sugar.

- To Stop caramelize in molasses storage tank.
- A m/c Boiling time to be minimized and to stop hot water addition in A m/c boiling.
- To maintain B-Seed, C-Seed sugar colour and Purity.
- Separator of A heavy / A Light molasses perfectly.

14. can you share one of the best teachings given to you by your Father ?

My father always encouraged me for better education. I am elder in my family hence he always guided me to insist on joint family and I am following his teachings even today.

15. Can you share one of the best teachings given to you by your Mother ?

My Mother always taught me to Be honest, always be kind enough with others and be helpful to family and friends during hard days.

16. What do you like to do during leave or off days ?

I spend my holiday with my family and take rest and also plan my next week working schedule.

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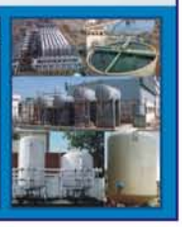

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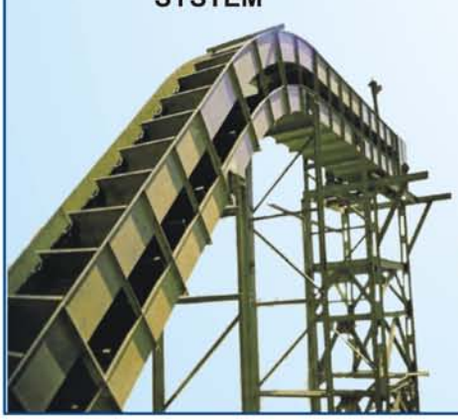

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Mr. Babubhai Mistry
Managing Director

Mr. Babubhai Mistry is a highly experienced technocrat owning a rich experience working on various projects in the area of project design, execution and installation and commissioning. He is the founder of CHAMUNDA ENGINEERING PVT LTD. And looks after the day to day performance of the company. Due to his strong belief in providing quality services to clients has earned him a special place in the hearts of his clients.

Mr. Babubhai Mistry has successfully guided the company towards establishing a premier position in the market due to stringent quality norms without any compromise. He made the professional journey of the company easy and during his regime the company witnessed the age of tremendous growth and expansion.

Mr. Babubhai Mistry Managing Director of Chamunda Engineering revels "Taking the leadership role means having a vision about what can be accomplished and making a commitment to the mission and to the people you lead plus assuming the risk of loss and failure while accepting recognition for success" He adds "I have worked towards improving my strengths, overcome my weaknesses and negative attitudes while considering external threats and opportunities in favour. Then I have drawn my attention in developing a range of interpersonal and transferable business skills"

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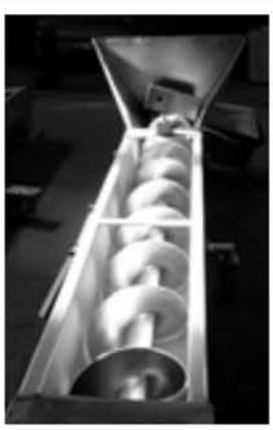
Link (India) Machinery Pvt. Ltd.

Mfg. Sugar Mill Spares, any Customised Mechanical Spare Parts and any type of Graded Alloy Casting & Fabrications



Some of Our Products.....

- Trash Plates
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- Boiler Door Frames
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- Boiler Grate Bars
- Boiler Trunion Bars
- Mill Roller
- Bucket for Sugar Elevator
- Boiler Spares and Casting Covers Doors
- Chain & Chain Spares
- Mill Head Stock
- Knife
- Coupling
- Crown Pinion
- G M Bearing Liner
- Gear
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Mr.Babuhai Misrty shares his piece of advice "Today's managers or leaders, particularly those who are serving in the casting of ferrous and non ferrous metals, need to form an acceptable workplace environment that is guided with ethical behavioral guidelines towards productivity and moral responsibility"

Manufacturing Infrastructure

The company is having state-of-art manufacturing facilities at G.I.D.C. Vatva, Ahmedabad with Large capacity Casting Foundry with Furnace, Heavy Machining and Testing equipments.

The current Plant is having about 10,000 Square Feet Area including Office and Factory premises.

Casting Foundry

Boiling house equipements : Juice heaters, V. Evaporators. Crystallizer (Vertical & Horizontal) Syrup/juice Sulphitors, sugar hoppers & bagasse press etc. Melting Induction & Crucible Furnace

Metal Cast : Indian, British, American, German Standard Carbon Steel, High Tensile Steels Heat Resistance Alloys Steels, Abrasion Resistance Steel, Cast-iron Stainless Steel Casting (Single Job Up To 10 Ton) All Grade of Bronze, Gunmetal, Aluminum castings, (Single Job Up To 2000 kg)

Moulding : Dry Sand, Green Sand, Co2 Sand & No bake moulding

Item : LOTUS, Material :
Panch Dhatu (5Kg Gold), Wt : 18000Kgs

Core Making : Oil sand, Co2 Sand, No Bake & Shell Care

Inspection & testing : Chemical Analysis, Physical Testing, Hardness, Spectro Graphic Analysis.

For All Your Requirements of Casting : (Ferrous & Non Ferrous)

Sugar Mill House Machineries & Its Spares

Cane Kicker & leveler assembly Knives, hubs, Plummer blocks etc. Fibrizor assembly (swing & fix type) hammer, hubs, shafts, Plummer Blocks Etc. TRPF Roller assembly mill spares head stocks, Crown pinions, Sq. Coupling, Tail Bars, Trash Beams, Trash Plates, Scrapper-plates, Taper wedges, Sprockets, Rake, Slates, Bearing Housing, Bronze / Gun Metal Bearing Liners, Wear plates & housings, white metal bearing, pedestal, gears & Pinion, worm & worm wheels, Centrifugal machine spares, Accelerating cup, basket bottom, basket support top ring spider hub, top cap, second motion gear & pinion, GRPF head stock, Boiler Spares like door, door frames, fire bars, trunion bars, Bolts & Nuts, etc.

Boiler Spares

The Large range for Boilers Spares and Casting Covers Doors, Door Frames, Fire Bars, Grate Bars, Trunion Bars, etc. Prepared from Heat Resistant Alloy Cast Iron.

Quality

The quality has received main focus and attention in the modern era and there has been an increased awareness of its importance in all businesses. The 'Quality management' has come to mean more than avoiding errors. Certainly there is a growing realization that high quality goods and services can give an organization a considerable competitive edge. The implementations of

quality principles are main criteria to improve the quality of various section of an organization on the whole.

We adopt different steps of a quality management such as quality control, quality assurance and Total quality management. The role of quality in different sections of the organizations is equally important. the role of quality in 'Training and development' very important in an organization to achieve their end goal by developing quality staff.

1. Corporate support to ensure quality at all level from manufacturing to end customer.

2. Continuous improvement at all level through corporate strategies.
3. To make affordable quality products to all.
4. Access to the best quality products through best service.
5. Access to modern technology for training and development of employees
6. Quality standard for delivery of products and services

Expansion Plans:

The company has already purchased a new Factory in GIDC Vatva for the Expansion. That plant will also been started within one year.

Expansion plant will have international standard equipments and will work for Export of heavy casting jobs. At present the company manufacture the Sugar Mill Spares Castings & parts and Boiler Parts. In the nearer future, the company will start all type of castings.

CHAMUNDA ENGINEERING PVT. LTD.

79/80, Mahalaxmi Industrial Estate, Nr. Bombay Conductors, Vatva, Ahmedabad - 382 445. Gujarat INDIA.
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"FLOWRISE" BRAND PINCH VALVES

Merits of "FLOWRISE" Pinch Valves.

Pinch Valve is a seat less, glandless valve and an modified up-dated version of Lab. Pinchcock. the rubber sleeve in pinch valve is protected under a metallic casing (i:e Cast steel, Cast Iron, Stainless Steel, Aluminum.) thus the fluid passing through do not come into contact with either body covering or any other metal parts of the valve except the rubber sleeve.

The valve is hand wheel operated of rising stem wheel hence the operation of the valve is just smooth as other wheel operated valves. The pinch valves offers positive and smooth flow with fine control over flowing media / application.

Features of "FLOWRISE" PINCH VALVES

- Easily and smoothly replaceable elastomeric sleeve,
- Same face to face as Ball-Plug-Gabe valves up to 12"
- No packing require ever maintain.
- Excellent throttling characteristics
- 100% Full Port
- Self Cleaning,
- Glandless and seat less valves.
- Straight full flow
- No liquid hammering
- Split casting ensures quick maintenance of the valve
- Valve incorporates all
- Elastomer sleeve having four layer of reinforced pulling lugs
- Flange end connection with drilling to class 150, Table-D,E,DIN
- Our design modifications based
- Construction to handle abrasive corrosive media .

SIZE RANGE OF "FLOWRISE" PINCH VALVES :

SIZE : 25MM TO 400MM

DESIGN TYPE OF VALVES : Open & Close Body Pinch Valve.

OPERATION : Handle and Wheel, Worm Gear, Pneumatic Actuator, Chain, Above valve available in Flange End and Screwed End.

BEENA ENGINEERING WORKS is the Manufacturer of **"FLOWRISE"** BRAND Pinch Valves, Knife Edge Gate Valves, Pulp Valves, Butterfly Valves, Diaphragm Valves, Dual Plate Check Valves etc. Body Since 1989. and one of the Quality Valves Player of Pinch Valves manufacturer in India.

For Further details Please Contact :
BEENA ENGINEERING WORKS
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E-Mail : beenavalves@gmail.com

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Industrial Progressive Cavity Pumps - Naishit Pumps Industries

'NI' Series Naishit Progressive Cavity Pumps are used for a wide variety of pumping and transfer duties. They are found in tough rugged industrial applications handling anything from abrasive slurries, aggressive or reactive chemicals, to viscous liquids, oils, or suspensions and aqueous solutions at elevated temperatures. These Screw pumps consists torsion free metal bonded stator for increased stator life, higher efficiency and per stage pressure. Simple Cost Iron constructions with internal rotating spare parts and helical rotor of alloy steel / stainless steel / tool steel depending on the fluids to be handled. Shaft sealing ensured by gland packing with mechanical seal optional

Material of Construction Option :
ROTOR : Case Hardened Steel, Alloy Steel HCP,

Stainless Steel UP/HCP
COUPLING ROD : Alloy Steel, Stainless Steel
STATOR : Natural, Nitrile, High Nitrile, EPDM, Chloro-Sulphonated Rubber, Fluoroelastomer
HOUSINGS : Cast Iron, Cast Steel, CastStainless Steel, Fabricated Steel and Stainless Steel
SPECIAL MATERIAL : Other Exotic options including Alloy 20, Haste alloy also available..
Fluids Handled : Acidic & Alkaline slurry, Acrylic Emulsion, Black Liquor, Ceramic Slurry , Chemical Slurries, Dyestuff,Effluent, Emulsion, Explosive Slurry, Glue Paint, Magma, Molasses (all Grades),Oil, Petroleum jelly, Printing Ink, Solvents, Sodium Silicate , Sulphited Sugar Juice , Vegetable Oil , Viscose Yeast Etc.

MATERIAL OF CONSTRUCTION

Capacity Range 0.1 m3/hr to 250 m3/hr	
Temperature	upto 120 C
Pressure	Upto 48 Bar
Viscosity	1,00,000 cP

Housing Part Grey Cast Iron, Rubber/FRP Lined, AISA 304, AISI, 316, AISI316L, Hastealloy & Special alloys Stators :Natural, Nitrile, Neoprene, Viton, Silicon, other special quality grades, also food-grade
Rotar: Heat treated EN Steel, AISI 304, AISI 316 hard chrome plated and other special alloys, e.g. monel, hastealloy etc.

Other Rotating Parts:
Cr. Steel, AISI 304, AISI 316 and other special alloys e.g. monel, hastealloy etc.

Stator Material	General Resistance to
R-Natural Rubber	Water most moderate chemicals, wet or dry organic acids, Alcohols, Aldehydes.
P-Neoprene	Water alkalies moderate acids, non-aromatic petroleum and fatty oil solvents.
N-Nitrile	Oils & solvents.

Stator Material	General attached by	Max. Temp
R-Natural Rubber	Ozone, strong acids fats oils, greases most hydrocarbons	185F
P-Neoprene	Aromatic or cholorinated solvents ketones.	185F
N-Nitrile	Strong Acids	250F

'Naishit' is an ISO 9001-2008 certified company, manufacturing quality rubber products for automobile industries, sugar and fertilizer industries. The company manufacturers rubber stators for many foreign brands.

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"HI FLOW" Double Block and Bleed Valve

"HI FLOW" Double Block and Bleed Valve performs the tasks of 3 separate Valves (2 separate isolations and 1 drain Valve) which apart from being hugely space saving can also save on weight and time due to installation and maintenance practices requiring much less work and the operator being to locate and operate all 3 Valves in one location.

"HI FLOW" Double Block and Bleed Valve operates on the principle that isolation can be achieved from both the upstream and downstream process flow / pressures. This is achieved by two ball Valves placed back to back, with a third "isolatable" Valve in the centre cavity. Once isolation has been achieved in one or more of the main process isolation valves, the cavity that is created between these isolations can be drained. This is useful for flow diverting, sampling or injection situations, This is useful for flow diverting, sampling or injection situations, and for maintenance and or integrity check situations where seat leakage can be monitored through the third "bleed" Valve.

Bill of Material

Description	Material
Body	ASTMA182 Gr F60/UNS32205
Seat	Peek
Ball	ASTMA182 Gr F60/UNS32205
Stud & Nut M10x1.5	ASTMA182 Gr F60/UNS32205
Stem	ASTMA182 Gr F60/UNS32205
Trust Washer	Peek
Packing	Peek/Grafoil
Packing	Peek/Grafoil
Lok Nut	SS
Handle Isolate 2	CS/SS
Hex. Nut. M10	ASTM A453 Gr 660/UNS32205
Plan Washer	Peek
Seat Cover	ASTMA182 Gr F60/UNS32205
Handle Isolate 1	CS/SS
Gland Body	ASTMA182 Gr F60/UNS32205
Gland Washer	ASTMA182 Gr F60/UNS32205
Spindle	ASTMA182 Gr F60/UNS32205
Ball Isolate Valve	SS440C
Packing Washer	Peek
Packing	PTFE
Retainer	ASTMA182 Gr F60/UNS32205
Lock Nut	ASTMA182 Gr F60/UNS32205
Handle	CS/SS
Body Seal	Peek/Grafoil
Seat Seal	Peek/Grafoil
Adaptor	ASTMA182 Gr F60/UNS32205
Flange	ASTMA182 Gr F60/UNS32205
Antistatic Ball	SS316L
Spring	SS302

Hina Industries
Phone : +91 79 65250528, +91 2717 241050
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Engineers Environmental Consultant

Merchant Importer and Exporter

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- Thermal Power Plants
- Distillery Unit
- Metallurgical Industries
- Synthetic Organic Chemical Industries
- Sugar Industry
- Building and Large Construction Project

OUR CORE AREAS:

- Environmental Clearance
- Environmental Impact Assessment Studies (EIA)
- Consent to Establish and Operate
- Green Building Certification
- Environmental Monitoring and Reporting
- Feasibility Studies and DPR
- Energy Audit
- Renewable Energy Certificate
- CSR & CER Policy Formulation & Implementation
- Training and Coordination for Environmental Services

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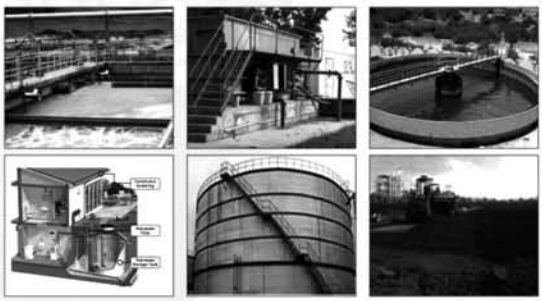
We are one of the prime Environmental Engineering Service provider company in India. Our services includes Design, Supply, Erection and Commissioning. We offer the most innovative, latest and cost effective technologies for the following engineering services :

WE OFFER THE FOLLOWING SYSTEM AND SERVICES:

- Water Treatment Plant
- ETP/STP
- Solid Waste Management (SWM)
- Automation & Modernization
- Bio-Digester
- Bio-Composting
- Venture wet Scrubber
- Rain Water Harvesting
- Distillery
- Ethanol
- Evaporation Plant
- PMC



IMPORT/EXPORT DIVISION:

We are exporting Agro Products like Indian Red Onion, Capsicum, Ginger, Raisins (Kismis) etc. Apart from this we export Ethanol to various part of the globe including African Continent. We are also exporting Molasses, Handicraft items and Spices.

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Indian Fresh Capcicum

Indian Red Onion

Ethanol (ENA)

Molasses

Plain White Candles

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