

# **Reliability Analysis of Centrifugal Pumps System Justifies Improvements in Gas Plant**

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## **INTRODUCTION**

Over the past several years, reliability has become an ever-increasingly important topic and component in the organizational continuous improvement tool box. Higher plant reliability reduces process and equipment failures costs as failure disruption decreases production output which in turn limits gross margin. Additionally, equipment failures also increase the probability of having a catastrophic environmental accident and the potential for increasing safety related accidents.

The strong competitive environment between companies to secure business and the current world financial crisis are forcing organizations to explore ways to reduce operating costs. A popular approach to reduce operating costs is to reduce expenditures on equipment maintenance. While results can be obtained by reducing investments in equipment, this approach is very short sighted. It is not unusual that deferred investments will re-surface and cost 2 to 5 times more than if addressed in the early stages of failure development.

The purpose of this paper is to objectively demonstrate that an approach focused on reliability, availability and maintainability prediction will help to detect pieces, equipments and systems that require improvements helping to maintenance managers to make the right decision analyzing a centrifugal pump system in a gas plant.

## **DEVELOPMENT**

The primary function of a NGL Recovery Gas Plant is to recover the rich component of gas (ethane, butane, propane and gasoline) known as "Soup". This soup is dispatched to a fractionating plant where the components are recovered again and then are sold to the market.

The centrifugal pump system analyzed is a critical part of the process, basically is the core of business. The main purpose of the centrifugal pumps is to take the soup out of the main recovery tower to send the NGL (Natural Gas Liquids) to the dispatching area (See Figure-1).

The pumps system is composed by two centrifugal pumps disposed in parallel, one pump is operating and the other pump is waiting to be demanded. The system for the reliability analysis is called "Stand-by redundancy" type 1 of 2, just one pump is in operating mode and the other pump is waiting for failure of the first pump. These are two-stage centrifugal pumps type (WTB) vertically spited; they are designed for heavy duty in refineries, electric centrals and for general services.

# Reliability Analysis Applied On Centrifugal Pumps

**Michael John Provost**



## **Reliability Analysis Applied On Centrifugal Pumps:**

**System Reliability Analysis** Akshay Kumar, Mangey Ram, Rajesh S. Prabhu Gaonkar, Yury Klochkov, 2024-12-30 The text covers both basic and advanced techniques based on state performance systems and binary systems The chapters will highlight reliability prediction series parallel and complex modeling It presents a dynamic reliability analysis of safety critical systems using Petri nets and dynamic resource allocation modeling of software with patching The text illustrates a semi Markov analysis of systems with a Weibull interface This book discusses in a comprehensive manner the reliability centered maintenance modeling of electric vehicle systems covers the reliability modeling of multi state systems under the product development stage and the reliability assessment of a multi state degraded system examines the role of nature inspired techniques in the reliability optimization of systems explores the practical challenges and solutions for RAMS management of train control systems and showcases the methodology for the assessment of multi state system reliability of traction electric drives including overload modes It is primarily written for graduate students and academic researchers in the fields of industrial engineering systems engineering manufacturing engineering production engineering mechanical engineering and mathematics

**Advanced Manufacturing and Automation VIII** Kesheng Wang, Yi Wang, Jan Ola Strandhagen, Tao Yu, 2018-12-14 This proceeding is a compilation of selected papers from the 8th International Workshop of Advanced Manufacturing and Automation IWAMA 2018 held in Changzhou China on September 25 26 2018 Most of the topics are focusing on novel techniques for manufacturing and automation in Industry 4 0 and smart factory These contributions are vital for maintaining and improving economic development and quality of life The proceeding will assist academic researchers and industrial engineers to implement the concepts and theories of Industry 4 0 in industrial practice in order to effectively respond to the challenges posed by the 4th industrial revolution and smart factory

**Computing, Control, Information and Education Engineering** Hsiang-Chuan Liu, Wen-Pei Sung, Wenli Yao, 2015-08-18 This proceedings set contains selected Computer Information and Education Technology related papers from the 2015 International Conference on Computer Intelligent Computing and Education Technology CICET 2015 to be held April 11 12 2015 in Guilin P R China The proceedings aims to provide a platform for researchers engineers and academics

**Applications of Computational Methods in Manufacturing and Product Design** B. B. V. L. Deepak, D.R.K. Parhi, B.B. Biswal, Pankaj C. Jena, 2022-05-04 This book presents the select proceedings of the conference of Innovative Product Design and Intelligent Manufacturing System IPDIMS 2020 held at the National Institute of Technology Rourkela India The book addresses latest methods and advanced tools from different areas of design and manufacturing technology The main topics covered include computational methods for robotics mechatronics and human computer interaction computer aided design manufacturing and engineering aesthetics ergonomics and UX UI design smart manufacturing and expert systems The contents of this book will be useful for researchers as well as professionals working in the areas of industrial design mechatronics robotics and automation

EAI

International Conference on Automation and Control in Theory and Practice Michal Balog,Angelina Iakovets,Stella Hrehova,2023-08-08 This book presents the proceedings of the 15th EAI International Conference on Automation and Control in Theory and Practice ARTEP 2023 held in Star Lesn Slovakia February 8 10 2023 The aim of the conference was to meet the experts in the field of control industrial automation and ICT in the industry from universities colleges and practice The conference aims to draw attention to modern trends in the field to enable experts pedagogues and scientific researchers to present the results achieved in their work to exchange experiences and establish working contacts between meeting participants The ARTEP proceedings includes papers on automation and control and their integration of technologies such as Industry 4 0 robotics and IoT ARTEP is primarily a conference for scientists and practitioners who develop and study automation management and technologies

**Advanced Fuzzy Logic Approaches in Engineering Science** Ram, Mangey,2018-09-14 Fuzzy logic techniques have had extraordinary growth in various engineering systems The developments in engineering sciences have caused apprehension in modern years due to high tech industrial processes with ever increasing levels of complexity Advanced Fuzzy Logic Approaches in Engineering Science provides innovative insights into a comprehensive range of soft fuzzy logic techniques applied in various fields of engineering problems like fuzzy sets theory adaptive neuro fuzzy inference system and hybrid fuzzy logic genetic algorithms belief networks in industrial and engineering settings The content within this publication represents the work of particle swarms fuzzy computing and rough sets It is a vital reference source for engineers research scientists academicians and graduate level students seeking coverage on topics centered on the applications of fuzzy logic in high tech industrial processes

Scientific and Technical Aerospace Reports ,1980 Engineering Asset Management Dimitris Kiritsis,Christos Emmanouilidis,Andy Koronios,Joseph Mathew,2011-02-03 Engineering Asset Management discusses state of the art trends and developments in the emerging field of engineering asset management as presented at the Fourth World Congress on Engineering Asset Management WCEAM It is an excellent reference for practitioners researchers and students in the multidisciplinary field of asset management covering such topics as asset condition monitoring and intelligent maintenance asset data warehousing data mining and fusion asset performance and level of service models design and life cycle integrity of physical assets deterioration and preservation models for assets education and training in asset management engineering standards in asset management fault diagnosis and prognostics financial analysis methods for physical assets human dimensions in integrated asset management information quality management information systems and knowledge management intelligent sensors and devices maintenance strategies in asset management optimisation decisions in asset management risk management in asset management strategic asset management and sustainability in asset management

**Fuzzy Logic Dynamics and Machine Prediction for Failure Analysis** Mushiri, Tawanda,Mbowhwa, Charles,2018-01-12 In the fast pace of the modern world it is important more than ever for factories to know how and why their machines are failing and what can be done to prevent it As

such it is imperative that new research is conducted to make sure that factories can operate as efficiently as possible Fuzzy Logic Dynamics and Machine Prediction for Failure Analysis is an essential reference source for the newest research on the risk assessment matrix ladder logic and computerized maintenance management systems CMMS Featuring widespread coverage across a variety of related viewpoints and topics such as the Ishikawa diagram machinery failure analysis and troubleshooting model reference adaptive control systems and proportional integral derivative PID controllers this book is ideally designed for professionals upper level students and academics seeking current research on the implementation of fuzzy logic in machine prediction failure **STAR**, 1973 *Technology for Large Space Systems*, 1987 *Servitization and Physical Asset Management* Michael John Provost, 2018-12-31 *Servitization and Physical Asset Management* third edition was developed to provide a structured source of guidance and reference information on the business opportunities linked to servitization and the management of physical assets A growing trend in the global economy servitization focuses on the actual deliverables of an asset from the perspective of the customer electricity instead of the power plant thrust instead of the engine mobility instead of a plane or a car The book offers high level overviews of how to servitized and manage assets from a variety of perspectives reviewing nearly 1 500 books magazine articles papers and presentations and websites Written by Michael J Provost Ph D and a subject matter expert in modeling simulation analysis and condition monitoring *Servitization and Physical Asset Management* third edition is an invaluable reference to those considering providing asset management services for the products they design and manufacture It is also meant to support middle management wishing to know what needs to be done to look after the assets they are responsible for and who to approach for help and academics doing research in this field Michael Provost is a British engineer with a doctoral degree in thermal power from Cranfield University

Applied Mechanics Reviews, 1970 Computer Program Abstracts, 1971 *Risk Analysis for Process Plant, Pipelines and Transport* J. R. Taylor, 1994 This book gives a detailed description of practical risk and safety analysis methods tried and tested in over 100 process industry projects The aim is to provide the methods and data needed by practicing safety engineers as **Life Cycle Costing for Engineers** B.S. Dhillon, 2009-10-26 Cradle to grave analyses are becoming the norm as an increasing amount of corporations and government agencies are basing their procurement decisions not only on initial costs but also on life cycle costs And while life cycle costing has been covered in journals and conference proceedings few if any books have gathered this information into an **Process Machinery Handbook** Robert X. Perez, 2025-06-10 *Process Machinery Handbook* For Field Personnel Decision Makers and Students equips newcomers and seasoned professionals with essential insights into the diverse world of process machinery empowering them to understand unique performance characteristics common failure modes and effective strategies for enhancing reliability in their operations Any professional working at a production site for any length of time knows that process machinery comes in a wide range of designs and sizes but not all process machines are considered equal Some machines are more critical to the process than

others some are small some are very large some spin fast and some turn relatively slowly The great diversity in their construction and application can be daunting to those new to the industry and sometimes even challenge machinery veterans There are many common concepts that apply to all equipment types but each equipment category has its own unique application and performance characteristics including cavitation in liquid handling pumps surging in centrifugal gas compressors rotor instability in high speed centrifugal compressors and the effect of the compression ratio on a reciprocating compressor s the discharge temperature It is also essential for users to understand how and why different types of machinery fail keeping in mind that the common failure modes differ greatly between rotating machinery types We know that by addressing the common types of failure modes associated with each machine type we can achieve significant improvements in their reliability The first step in organizing an effective machinery reliability program is committing to performing failure analyses and gathering failure statistics These activities will help users learn how and why their machines are failing The next step is to continuously modify machines processes and methods to avoid common failures Process Machinery Handbook For Field Personnel Decision Makers and Students gives students and professionals alike the tools they need to understand the fundamentals of working with rotating machinery **Mechanical Engineering** ,1922 **Smart Flow Control Processes in Micro Scale Volume 2** Bengt Sundén, Jin-yuan Qian, Junhui Zhang ,2020-12-29 In recent years microfluidic devices with a large surface to volume ratio have witnessed rapid development allowing them to be successfully utilized in many engineering applications A smart control process has been proposed for many years while many new innovations and enabling technologies have been developed for smart flow control especially concerning smart flow control at the microscale This Special Issue aims to highlight the current research trends related to this topic presenting a collection of 33 papers from leading scholars in this field Among these include studies and demonstrations of flow characteristics in pumps or valves as well as dynamic performance in roiling mill systems or jet systems to the optimal design of special components in smart control systems Fossil Energy Update ,1980

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## **Table of Contents Reliability Analysis Applied On Centrifugal Pumps**

1. Understanding the eBook Reliability Analysis Applied On Centrifugal Pumps
  - The Rise of Digital Reading Reliability Analysis Applied On Centrifugal Pumps
  - Advantages of eBooks Over Traditional Books
2. Identifying Reliability Analysis Applied On Centrifugal Pumps
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Reliability Analysis Applied On Centrifugal Pumps
  - User-Friendly Interface
4. Exploring eBook Recommendations from Reliability Analysis Applied On Centrifugal Pumps
  - Personalized Recommendations

- Reliability Analysis Applied On Centrifugal Pumps User Reviews and Ratings
- Reliability Analysis Applied On Centrifugal Pumps and Bestseller Lists
- 5. Accessing Reliability Analysis Applied On Centrifugal Pumps Free and Paid eBooks
  - Reliability Analysis Applied On Centrifugal Pumps Public Domain eBooks
  - Reliability Analysis Applied On Centrifugal Pumps eBook Subscription Services
  - Reliability Analysis Applied On Centrifugal Pumps Budget-Friendly Options
- 6. Navigating Reliability Analysis Applied On Centrifugal Pumps eBook Formats
  - ePub, PDF, MOBI, and More
  - Reliability Analysis Applied On Centrifugal Pumps Compatibility with Devices
  - Reliability Analysis Applied On Centrifugal Pumps Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Reliability Analysis Applied On Centrifugal Pumps
  - Highlighting and Note-Taking Reliability Analysis Applied On Centrifugal Pumps
  - Interactive Elements Reliability Analysis Applied On Centrifugal Pumps
- 8. Staying Engaged with Reliability Analysis Applied On Centrifugal Pumps
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Reliability Analysis Applied On Centrifugal Pumps
- 9. Balancing eBooks and Physical Books Reliability Analysis Applied On Centrifugal Pumps
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Reliability Analysis Applied On Centrifugal Pumps
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Reliability Analysis Applied On Centrifugal Pumps
  - Setting Reading Goals Reliability Analysis Applied On Centrifugal Pumps
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Reliability Analysis Applied On Centrifugal Pumps
  - Fact-Checking eBook Content of Reliability Analysis Applied On Centrifugal Pumps

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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