

## Analysis Of Casting Defects And Identification Of Remedial

*This volume contains a selection of papers presented at the 7th Nirma University International Conference on Engineering 'NUiCONE 2019'. This conference followed the successful organization of four national conferences and six international conferences in previous years. The main theme of the conference was "Technologies for Sustainable Development", which is in line with the "SUSTAINABLE DEVELOPMENT GOAL" established by the United Nations. The conference was organized with many interdisciplinary technical themes encompassing a broad range of disciplines and enabling researchers, academicians and practitioners to choose between ideas and themes. Besides, NUiCONE-2019 has also presented an exciting new set of events to engage practicing engineers, technologists and technopreneurs from industry through special knowledge sharing sessions involving applied technical papers based on case-study applications, white-papers, panel discussions, innovations and technology products. This proceedings will definitely provide a platform to proliferate new findings among researchers. Advances in Transportation Engineering Emerging Trends in Water Resources and Environmental Engineering Construction Technology and Management Concrete and Structural Engineering Futuristic Power System Control of Power Electronics Converters, Drives and E-mobility Advanced Electrical Machines and Smart Apparatus Chemical Process Development and Design Technologies and Green Environment Sustainable Manufacturing Processes Design and Analysis of Machine and Mechanism Energy Conservation and Management Advances in Networking Technologies Machine Intelligence / Computational Intelligence Autonomic Computing Control and Automation Electronic Communications Electronics Circuits and System Design Signal Processing*

*This book describes systematically the theory and technology of the precision forming of large, complex and thin-walled superalloy castings for aircraft engines, covering all the important basic aspects of the manufacturing process, including process design, wax pattern, ceramic molds, casting and solidification, heat treatment, repair casting and dimension precision control. The correlation of casting defects, structural characteristics and performance of castings is revealed through a range of tests. It also discusses the latest technologies and advances in this field - such as imaging the solidification process by means of synchrotron radiography, 3D computerized tomography and reconstruction of microporosity defects, analysis and diagnosis of error sources for dimension over-tolerance and adjusted pressure casting technology - which*

*are of particular interest. Providing essential insights, the book offers a valuable guide to the design and manufacture of superalloy casting parts for aircraft engines.*

*International conference supported by Indian Statistical Institute, held at Bangalore, 20-22 December, 2011; selected papers.*

*A Consultative Knowledge-based Expert System for the Analysis of Casting Defects*

*Proceedings of 6th Geoarchaeological Conference, Miass, Russia, 16-19 September 2019*

*Metal Casting: Principles And Practice*

*Advances in Materials, Mechanical and Industrial Engineering Proceedings of the National Conference on Investment Casting*

Contributed papers presented at the conference held at Central Mechanical Engineering Research Institute, Durgapur.

This book presents selected papers from the 1st International Conference on Industry 4.0 and Advanced Manufacturing held at the Indian Institute of Science, Bangalore and includes deliberations from stakeholders in manufacturing and Industry 4.0 on the nature, needs, challenges, opportunities, problems, and solutions in these transformational areas. Special emphasis is placed on exploring avenues for creating a vision of, and enablers for, sustainable, affordable, and human-centric Industry 4.0. The book showcases cutting edge practice, research, and educational innovation in this crucial and rapidly evolving area. This book will be useful to researchers in academia and industry, and will also be useful to policymakers involved in creating ecosystems for implementation of Industry 4.0.

Subsequent to the production of American Casting Institute Type HF stainless steel castings, two types of casting defects have been found: hot tearing and shrinkage. Analyses of castings with these types of defects have been conducted. The hot tears were detected by fluorescent dye penetrant inspection and were found to be confined to certain similar locations in separate castings. The shrinkage was detected by gamma radiography and was confined to the interior of one casting. The investigation of the hot tearing condition has led to a metallographic definition of carbide distributions and a tentative microchemical description of the area containing the hot tear. A metallographic and microchemical characterization of the interdendritic region near those areas displaying shrinkage and microshrinkage in a different HF stainless steel casting has also been made. In both cases, a description of the means by which the casting defects were eliminated is included. Scanning electron microscope, energy-dispersive X-ray analysis, and surface replication techniques were used, as well as routine metallographic procedures.

**Stainless Steel Castings**

**An Analysis of Two Casting Defects in Parts Made from ACI Type HF Heat-Resistant Stainless Steel**

**Database and Expert Systems Applications**

**Industry 4.0 and Advanced Manufacturing**

*This book comprises selected proceedings of the International Conference on Engineering*

*Materials, Metallurgy and Manufacturing (ICEMMM 2018). It discusses innovative manufacturing processes, such as rapid prototyping, nontraditional machining, advanced computer numerical control (CNC) machining, and advanced metal forming. The book particularly focuses on finite element simulation and optimization, which aid in reducing experimental costs and time. This book is a valuable resource for students, researchers, and professionals alike.*

*A program was conducted to assess the effects of casting defects in directionally solidified (DS) material. The technical approach involved two tasks, the first including the characterization of typical casting defects in F- 100 1st and 2nd stage PWA-1422 production turbine blades and the second including the evaluation of thin sheet test specimens cast deliberately to contain defects. The defects included microshrinkage, inclusions and grain misorientation and represented a range of severity levels including conditions exceeding current production acceptance criteria. The analysis of production castings indicated that substantial decreases in the rejection rate could be achieved with only minor relaxation of the acceptability criteria. In addition, dross inclusions were found to be the single most frequent cause for casting rejections.*

*Knuckle connectors on railcars are required to sustain thousands of cyclic stress events. Manufacturers continue to develop, test, and improve the life of these castings, which are now designed to exceed 400,000 cycles when subjected to tests involving cumulative cyclic sinusoidal load range settings varying between 6800 and 127,000 kgf at room temperature. This paper addressed real-world difficulties of differentiating between component failures due to overload and casting defects, and those that result from fatigue damage. Fatigue fractures in castings are rarely planar and comprise areas where solidification kinetics are different, and locations where porosity or large inclusions are present. The cumulative effect these factors have on fracture is to generate a rough topography, which may exhibit no beachmarks or other outward sign by which a fatigue fracture is commonly recognized. In this paper, an advantage was gained over a field failure because the fracture was produced in a laboratory test. Cycles to failure was recorded and details of the applied cyclic stress were also known. The difficulty regarding scanning electron microscope (SEM) analysis was that classic fatigue features normally visible to the naked eye, such as beachmarks, thumbnail initiation sites and planar areas, were not evident on the fracture face. In addition to documentation of numerous defect features on the fracture surface, SEM analysis revealed a rare but proof-positive form of evidence for propagation of the early stages of fracture by fatigue. The feature has been described in the literature as "tire tracks," alluding to their similarity to ATV tire impressions or Lunar Rover tracks on the moon. A brief review of earlier literature examples of tire track features is provided, and the generally accepted mechanism for their formation is assessed.*

*4th International Conference, DEXA'93, Prague, Czech Republic, September 6-8, 1993.*

*Proceedings*

*Proceedings of the First International Conference on Combinatorial and Optimization, ICCAP 2021, December 7-8 2021, Chennai, India*

*NCIC 2003*

*Handbook of Materials Failure Analysis with Case Studies from the Aerospace and Automotive Industries*

*Guss aus Kupferlegierungen*

Metal casting is a manufacturing process of solidifying molten metal in a mold to make a product with a desired shape. Based on its own unique fabrication benefits, it is one of the most widely used manufacturing processes to economically produce parts with complex geometries in modern industry, especially for transportation and heavy equipment industries where mass production is needed. However, various

types of defects typically exist in the as-cast components during the casting processes, which may make it difficult for post-processing and limit the service life and further application of products. It becomes imperative to analyze the processes in actual manufacturing conditions to predict and prevent those casting defects. Since it can be quite time consuming and costly to assess the processes experimentally, a computer-aided approach is highly desirable for product development and process optimization. In recent decades, computer-aided engineering (CAE) techniques have been rapidly developed to simulate different casting processes, which have great benefits to tackle casting defects in a more practical and efficient way. This work focuses on using ProCAST®, a finite element analysis (FEA) software, together with other necessary simulation and modeling techniques, including Computer-Aided Design (CAD), Calculation of Phase Diagrams (CALPHAD) and Cellular Automaton (CA), to study relevant defects in actual metal casting foundries. Specifically, three different cases have been mainly investigated, including (i) veining defect caused by thermal cracking in resin-bonded silica sand molds/inserts for sand casting process; (ii) thermal fatigue cracking in H13 steel dies/inserts for high pressure die casting process; and (iii) Hydrogen-induced gas porosity in A356 castings for gravity casting process with permanent molds. For each case, CAD model was designed and FEA model was constructed with validated materials database based on CALPHAD simulation, experiment tests and/or literature references. Coupled calculations of heat transfer, fluid flow for mold filling, and/or stresses and strains were run to obtain thermal and structural data for subsequent defects analyses and predictions. More importantly, key experiments at laboratory scale were designed and performed to reproduce those defects. Test results were employed to correlate and validate the predictions from simulation. The highlight of this dissertation is that an improved model and/or prediction criterion is proposed for each defect case and is dedicated to engineering applications, including (i) a statistics-based cracking criterion of resin-bonded silica sand molds or inserts in casting processes; (ii) a temperature-based fatigue life prediction criterion for thermally-induced cracking in H13 steel dies for die casting; and (iii) a coupled CA-FE model for location-specific prediction of gas porosity in A356 gravity castings with permanent molds. This research is aiming at demonstrating that the integration of different CAE techniques and key experimental validations can help tackle the defects in various casting processes in a time-efficient and cost-effective manner. The results and the approach may be of great benefits to casting engineers for defect assessments and design optimizations in different casting processes.

This e-book is a compilation of papers presented at the Mechanical Engineering Research Day 2016 (MERD'16) - Melaka, Malaysia on 31 March 2016.

This collection encompasses the following four areas: (1) Solidification processing: theoretical and experimental investigations of solidification processes including castings solidification, directional solidification of alloys, electromagnetic stirring, ultrasonic cavitation, mechanical vibration, active cooling and heating, powder bed-

electron beam melting additive manufacturing, etc. for processing of metals, polymers and composite materials; (2) Microstructure Evolution: theoretical and experimental studies related to microstructure evolution of materials including prediction of solidification-related defects and particle pushing/engulfment aspects; (3) Novel Casting and Molding Processes: modeling and experimental aspects including high pressure die casting, permanent casting, centrifugal casting, low pressure casting, 3D silica sand mold printing, etc.; and (4) Cast Iron: all aspects related to cast iron characterization, computational and analytical modeling, and processing.

Predicting and Validating Multiple Defects in Metal Casting Processes Using an Integrated Computational Materials Engineering Approach

Proceedings of the 7th Nirma University International Conference on Engineering (NUiCONE 2019), November 21-22, 2019, Ahmedabad, India

Relationship Between Solidification Parameters and Casting Defects

Analysis of Casting Defects of Precision Investment Casting of Aluminium Jewellery by Lost Wax Method

Effects of Core Aggregates on White Iron Casting Defects

Torrance Casting is an iron foundry located in La Crosse, Wisconsin. The foundry produces castings by melting raw materials into molten iron, which are then poured into molds created from compressed sand. While creating castings from molten iron is a considerably low tech endeavor, there are many opportunities to improve the efficiency of their business through computer software. The process of creating castings produces a large array of data that must be recorded for accounting, defect analysis and process control.

Currently this data is recorded manually on paper forms and filed away for future reference. This manuscript describes the design and development of a software application for an iron foundry in process control, data collection, and defect identification. The application allows the foundry workers to replace current paper processes with a flexible interactive process to record data produced in the casting process. It also replaces manual data collection with intuitive graphical data entry screens. This data can later be easily analyzed to determine the cause of casting defects.

This proceeding constitutes the thoroughly refereed proceedings of the 1st International Conference on Combinatorial and Optimization, ICCAP 2021, December 7-8, 2021. This event was organized by the group of Professors in Chennai. The Conference aims to provide the opportunities for informal conversations, have proven to be of great interest to other scientists and analysts employing these mathematical sciences in their professional work in business, industry, and government. The Conference continues to promote better understanding of the roles of modern applied mathematics, combinatorics, and computer science to acquaint the investigator in each of these areas with the various techniques and algorithms which are available to assist in his or her research. We selected 257 papers were carefully reviewed

and selected from 741 submissions. The presentations covered multiple research fields like Computer Science, Artificial Intelligence, internet technology, smart health care etc., brought the discussion on how to shape optimization methods around human and social needs.

This book contains chapters on cutting-edge developments presented at the TMS annual conference of 2012.

Select Proceedings of ICEMMM 2018

Defect Analysis and Data Collection Software for an Iron Foundry

Data-Driven Optimization of Manufacturing Processes

Analysis of Casting Defects. 3.ed

Advances in Interdisciplinary Research in Engineering and Business Management

All machining process are dependent on a number of inherent process parameters. It is of the utmost importance to find suitable combinations to all the process parameters so that the desired output response is optimized. While doing so may be nearly impossible or too expensive by carrying out experiments at all possible combinations, it may be done quickly and efficiently by using computational intelligence techniques. Due to the versatile nature of computational intelligence techniques, they can be used at different phases of the machining process design and optimization process. While powerful machine-learning methods like gene expression programming (GEP), artificial neural network (ANN), support vector regression (SVM), and more can be used at an early phase of the design and optimization process to act as predictive models for the actual experiments, other metaheuristics-based methods like cuckoo search, ant colony optimization, particle swarm optimization, and others can be used to optimize these predictive models to find the optimal process parameter combination. These machining and optimization processes are the future of manufacturing. Data-Driven Optimization of Manufacturing Processes contains the latest research on the application of state-of-the-art computational intelligence techniques from both predictive modeling and optimization viewpoint in both soft computing approaches and machining processes. The chapters provide solutions applicable to machining or manufacturing process problems and for optimizing the problems involved in other areas of mechanical, civil, and electrical engineering, making it a valuable reference tool. This book is addressed to engineers, scientists, practitioners, stakeholders, researchers, academicians, and students interested in the potential of recently developed powerful computational intelligence techniques towards improving the performance of machining processes.

This book presents selected extended papers from The First International Conference on Mechanical Engineering (INCOM2018), realized at the Jadavpur University, Kolkata, India. The papers focus on diverse areas of mechanical engineering and some innovative trends in mechanical engineering design, industrial practices and mechanical engineering education. Original, significant and visionary papers were selected for this edition, specially on interdisciplinary and emerging areas. All papers were peer-reviewed.

Die vorliegende Ausgabe umfasst die wichtigsten Grundlagen und Verfahrensweisen für das Gießen von Kupferlegierungen. Dabei werden Grundlagen des Erstarrungsverhaltens von Legierungen und der innerbetrieblichen Prüfung der Schmelzqualität zusammen mit Darlegungen über die Sandprüfung und über chemische Bindersysteme berücksichtigt. Das Werk "Guss aus Kupferlegierungen" bietet sowohl dem erfahrenen Schwermetallgießer, dem Neueinsteiger und Lernenden wichtige und nützliche Informationen. Weitreichende Literaturhinweise vervollständigen das Informationsangebot und sind in allen Abschnitten des Buches aufgeführt.

Analysis of casting defects

Manufacturing Technology : Foundry, Forming & Welding,2e

Precision Forming Technology of Large Superalloy Castings for Aircraft Engines

Advances in the Science and Engineering of Casting Solidification

TMS 2012 141st Annual Meeting and Exhibition, Materials Properties, Characterization, and Modeling

*Handbook of Materials Failure Analysis: With Case Studies from the Aerospace and Automotive Industries provides a thorough understanding of the reasons materials fail in certain situations, covering important scenarios, including material defects, mechanical failure as a result of improper design, corrosion, surface fracture, and other environmental causes. The book begins with a general overview of materials failure analysis and its importance, and then logically proceeds from a discussion of the failure analysis process, types of failure analysis, and specific tools and techniques, to chapters on analysis of materials failure from various causes. Later chapters feature a selection of newer examples of failure analysis cases in such strategic industrial sectors as aerospace, oil & gas, and chemicals. Covers the most common types of materials failure, analysis, and possible solutions Provides the most up-to-date and balanced coverage of failure analysis, combining foundational knowledge, current research on the latest developments, and innovations in the field Ideal accompaniment for those interested in materials forensic investigation, failure of materials, static failure analysis, dynamic failure analysis, fatigue life prediction, rotorcraft, failure prediction, fatigue crack propagation, bevel pinion failure, gasketless flange, thermal barrier coatings Presents compelling new case studies from key industries to demonstrate concepts Highlights the role of site conditions, operating conditions at the time of failure, history of equipment and its operation, corrosion product sampling, metallurgical and electrochemical factors, and morphology of failure*

*In This Book, The Topics/Syllabus Adequately Cover Metal Casting Subject In The Courses Of Mechanical, Production And Metallurgy Branches For B.E., B.Tech. As Well As Production And Industrial Metallurgy For M.Tech.With His Direct Experience In Metal Casting Industry And Teaching Academics The Author Attempts To Bridge The Gap Existing Between Essential Theory In Books And Vital Practical Applications In Industry.It Contains All The Molding Processes Normally Used With Details Of Ingredient Testing,Different Stages Of Casting Production Essential Theory Of Gating And Riser, As Well As Finishing, Inspection And Quality Control.Over 80 Line Sketches Facilitate Easy Understanding. Information Given Through Over 20 Tables Help Easy Comprehension, Comparison And Remembrance.*

*Exhaustive Examples Of Specific Components Normally Made By Casting Process Help To Build Confidence When Entering Industry. Over 200 Technical Books And Research Papers Upto May 1996 Are Referred. Examples Of Working Computer Programs Given, Form The Basis For Modern Practice-Oriented Projects In Final Year.For Practising Engineers, Managers And Entrepreneurs, This Book Provides Useful*

*Theory And Practical Aspects On Foundry Management. Exhaustive Treatment Of Critical Gating & Riser With Many Industry Examples, Practical Solutions To Melting Problems, Casting Defects Analysis Through Cause-Effect Diagrams Will Be Very Useful. Essential Information. On Energy Conservation And Environmental Pollution Control Is Also Given In The Last Chapter.*

*This book helps foundrymen eliminate or minimize inherent casting problems, improve casting quality and reduce cleaning and finishing costs.*

*Proceedings of I-4AM 2019*

*Technologies for Sustainable Development*

*Analysis of a Casting Fracture and Identification of Fatigue From Tire Track Markings*

*Analysis of Three Die Casting Campaigns and Assessment of Porosity-related Defects*

*Selected Contributions from the First International Conference on Mechanical Engineering, Jadavpur University, Kolkata, India*

**This book presents general problems in geoarchaeology, and discusses geophysical solutions, X-ray fluorescence spectrometry applications, X-ray and isotope analyses and GIS technologies. It also examines practical reconstructions of technological processes used in ancient time, and investigates the use of minerals and rocks by ancient societies in the territories of modern Russia, Ukraine, Turkmenistan, and Tajikistan, as well as the characteristics of ores, metallurgical slags and data on the composition and impurities of archaeological metals. Intended for archaeologists, historians, museum workers and geologists studying noble metals and copper, the book is also a useful resource for students, graduate students, experts and anyone interested in the use of various minerals at different stages of humanity's development.**

**Introduction; Liquid Metals and the Gating of Castings; Solidification 1 -- Crystallization and the development of cast structure; Solidification 2 -- the Feeding of Castings; The Moulding Material -- Properties, Preparation and Testing; Defects in Castings; Quality Assessment and Control; Casting Design; Production Techniques 1 -- the Manufacture of Sand Castings; Mould Production; Melting and Casting; Finishing Operations; Production Techniques 2 -- Shell, Investment and Die Casting Techniques; Production Techniques 3 -- Further Casting techniques; Environmental Protection, Health and Safety; Appendix; Index.**

**The volume contains latest research on software reliability assessment, testing, quality management, inventory management, mathematical modeling, analysis using soft computing techniques and management analytics. It links researcher and practitioner perspectives from different branches of engineering and management, and from around the world for a bird's eye view on the topics. The interdisciplinarity of engineering and management research is widely recognized and considered to be the most appropriate and significant in the fast changing dynamics of today's times. With insights from the volume, companies looking to drive decision making are provided actionable insight on each level and for every role using key indicators, to generate mobile-enabled scorecards, time-series based analysis using charts, and dashboards. At the same time, the book provides scholars with a platform to derive maximum utility in the area by subscribing to the idea of managing business through performance and business**

**analytics.**

**Geoarchaeology and Archaeological Mineralogy**

**Quality and Reliability Engineering: Recent Trends and Future Directions**

**Proceedings of Mechanical Engineering Research Day 2016**

**Contribution of Casting Geometry to Casting Defects**

**ICCAP 2021**

This volume constitutes the proceedings of the 4th International Conference on Database and Expert Systems Applications (DEXA), held in Prague, Czech Republic, in September 1993.

Traditionally the objective of the DEXA conferences is to serve as an international forum for the discussion and exchange of research results and practical experience among theoreticians and professionals working in the field of database and artificial intelligence technologies. Despite the fact that in the conference title the applications aspect is mentioned explicitly, the theoretical and the practical points of view in the field are well-balanced in the program of DEXA'93. The growing importance of the conference series is outlined by the remarkably high number of 260 submissions and by the support given by renowned organizations. DEXA'93 is held for the first time outside the former GDR in an East-European country, and is essentially contributing to the advancement of the East-West scientific cooperation in the field of database and AI systems. The proceedings contains the 78 contributed papers carefully selected by an international program committee with the support of a high number of subreferees. The volume is organized in sections: data models, distributed databases, advanced database aspects, database optimization and performance evaluation, spatial and geographic databases, expert systems and knowledge engineering, legal systems, other database and artificial intelligence applications, software engineering, and hypertext/hypermedia and user interfaces.

Analysis of Casting Defects

Advances in Manufacturing Processes

A Symposium Sponsored by ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys, Bal Harbour, Fla., 12-13 Nov. 1980

An MPMD Symposium Honoring Doru Michael Stefanescu  
Foundry Technology