

## ADDITIVE MANUFACTURING TECHNOLOGY - CHALLENGES AND OPPORTUNITIES IN COVID-19 PANDEMIC TIMES

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**Abstract:** Additive Manufacturing is a technology for manufacturing finished products, layer by layer. It is different from conventional processes, such as stamping / casting. It is a computer system, using projects in Computer Added Design that use 3D printing to join different materials to the final product of the form, through heat and other processes, such as the final application. The materials used are ceramic, metallic and polymeric micro / nanometric powders or a mixture of them. It was in the mid-80s of the 20th century that developments of this technology began. Additive manufacturing is of great importance for industries, as it eliminates the models / stamping molds / forging tools and molds / molds, because the goods are manufactured in their final geometry. The challenges are the cost of production and quality of the produced part, which must have the same or better performance than that manufactured by conventional methods. In the midst of the Covid-19 pandemic that hit 2020, additive manufacturing came as an aid to create personal protective equipment such as visors produced by companies, educational and research institutions or ordinary citizens. The present work presents this technology, its challenges and the beneficial aspects that it can generate for humanity in Covid-19 times and after.

**Keywords:** Additive Manufacturing. Technology. Additives. Materials. Challenges. Pandemic. Covid-19.

**Nomenclature**

3DP – 3 Dimensional Printing

BJ – Binder Jetting

AM – Additive Manufacturing

DED – Direct Energy Deposition

DMD – Direct Metal Deposition

DMLS – Direct Metal Sintering

LOM – Laminated Object Manufacturing

LMD – Laser Metal Deposition

ME – Material Extrusion

MJ – Material Jetting

MJS – Multiplayer Jet Solidification

NASA – National Aeronautics and Space

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# Download Additive Manufacturing Opportunities Challenges Implications

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Additive Manufacturing William H. Phillips, 2015 Additive manufacturing has the potential to fundamentally change the production and distribution of goods Unlike conventional or subtractive manufacturing processes such as drilling which create a part by cutting away material additive manufacturing builds a part using a layer by layer process Additive manufacturing has been used as a design and prototyping tool but the focus of additive manufacturing is now shifting to the direct production of functional parts parts that accomplish one or more functions such as medical implants or aircraft engine parts that are ready for distribution and sale This book discusses the use of additive manufacturing to directly produce functional parts including its opportunities key challenges and key considerations for any policy actions that could affect its future use This book explores the development and application of additive manufacturing as well as initiatives in the United States and other countries to advance it It also examines the technology's effect on firm and industry production activities as well as the potential implications for U S manufacturing competitiveness focused in three industries **From Additive**

**Manufacturing to 3D/4D Printing 1** Jean-Claude André, 2017-11-29 In 1984 additive manufacturing represented a new methodology for manipulating matter consisting of harnessing materials and or energy to create three dimensional physical objects Today additive manufacturing technologies represent a market of around 5 billion euros per year with an annual growth between 20 and 30% Different processes materials and dimensions from nanometer to decameter within additive manufacturing techniques have led to 70 000 publications on this topic and to several thousand patents with applications as wide ranging as domestic uses Volume 1 of this series of books presents these different technologies with illustrative industrial examples In addition to the strengths of 3D methods this book also covers their weaknesses and the developments envisaged in terms of incremental innovations to overcome them 3D Printing Timothy M. Persons, 2015-07-30 Additive manufacturing has the potential to fundamentally change the production and distribution of goods Unlike conventional or subtractive manufacturing processes such as drilling which create a part by cutting away material additive manufacturing builds a part using a layer by layer process The focus of additive manufacturing is now shifting to the direct production of functional parts parts that accomplish one or more functions such as medical implants or aircraft engine parts that are ready for distribution and sale This report presents the highlights of a forum convened on October 15 16 2014 to discuss the use of additive manufacturing to directly produce functional parts including its opportunities key challenges and key considerations for any policy actions that could affect its future use Table and figures This is a print on demand report **3D Printing and**

**Its Impact on the Production of Fully Functional Components: Emerging Research and Opportunities** Kocovic, Petar, 2017-05-30 Manufacturing processes have undergone significant developments in recent years With the application of new technology the productivity of companies has increased tremendously 3D Printing and Its Impact on the Production of Fully Functional Components Emerging Research and Opportunities is an innovative source of scholarly research on the

advancements of 3D printing technology in modern manufacturing processes Highlighting critical perspectives on topics such as industrial applications 3D modeling and bioprinting this publication is ideally designed for professionals academics engineers students and practitioners interested in the latest trends in additive manufacturing *The Next Production Revolution Implications for Governments and Business* OECD,2017-05-10 This publication examines the opportunities and challenges for business and government associated with technologies bringing about the next production revolution These include a variety of digital technologies e g the Internet of Things and advanced robotics industrial *Digital Transformation in Industry* Vikas Kumar,Jiewu Leng,Victoria Akberdina,Evgeny Kuzmin,2022-04-21 This book offers a selection of the best papers presented at the annual international scientific conference Digital Transformation in Industry Trends Management Strategies DTI2021 held by the Institute of Economics Ural Branch of the Russian Academy of Sciences in Ekaterinburg Russia on October 29 2021 The book focuses on the idea of introduction mechanisms for digitization processes and on highlighting successful digital transformation strategies in all sectors of industry Key topics include the development of a cyber physical production system for Industry 4 0 digital design technologies for enhancing the competitiveness of products and companies digital twin driven product manufacturing and services and the effects of the industrial digital transformation on society and the environment With regard to implementing IT and other technological innovations lessons learned in developed and developing economies as well as small and large enterprises are included Given its scope the book offers a valuable asset for researchers and managers of industrial organizations alike 3D Printing, Intellectual Property and Innovation Rosa Maria Ballardini,Marcus Norrgård,Jouni Partanen,2016-04-24 3D printing or more correctly additive manufacturing is the general term for those software driven technologies that create physical objects by successive layering of materials Due to recent advances in the quality of objects produced and to lower processing costs the increasing dispersion and availability of these technologies have major implications not only for manufacturers and distributors but also for users and consumers raising unprecedented challenges for intellectual property protection and enforcement This is the first and only book to discuss 3D printing technology from a multidisciplinary perspective that encompasses law economics engineering technology and policy Originating in a collaborative study spearheaded by the Hanken School of Economics the Aalto University and the University of Helsinki in Finland and engaging an international consortium of legal design and production engineering experts with substantial contributions from industrial partners the book fully exposes and examines the fundamental questions related to the nexus of intellectual property law emerging technologies 3D printing business innovation and policy issues Twenty five legal technical and business experts contribute sixteen peer reviewed chapters each focusing on a specific area that collectively evaluate the tensions created by 3D printing technology in the context of the global economy The topics covered include current and future business models for 3D printing applications intellectual property rights in 3D printing essential patents and technical standards in additive

manufacturing patent and bioprinting private use and 3D printing copyright licences on the user generated content UGC in 3D printing copyright implications of 3D scanning and non traditional trademark infringement in the 3D printing context Specific industrial applications including aeronautics automotive industries construction equipment toy and jewellery making medical devices tissue engineering and regenerative medicine are all touched upon in the course of analyses In a legal context the central focus is on the technology s implications for US and European intellectual property law anchored in a comparison of relevant laws and cases in several legal systems This work is a matchless resource for patent copyright and trademark attorneys and other corporate counsel innovation economists industrial designers and engineers and academics and policymakers concerned with this complex topic

**Wood Waste Management and Products** Siti Noorbaini

Sarmin,Mohammad Jawaid,Rob Elias,2023-05-12 This book examines the application of wood waste in various advancements in environmental fields such as construction renewable energy bio absorbent and agricultural and wood based material Featuring illustrations and tables summarizing the latest research it gathers up to date information on the application of various types of wood waste which could be applied in a practical manner to materially reduce nuisance created by fallout of wood based industries from different sources Given its scope the book is a valuable reference book for research students and reference resources for researchers academics and industrial scientists working in the field of wood waste management and their utilization

Smart Industry - Better Management

Tanya Bondarouk,Miguel R. Olivas-Luján,2022-07-18 The ebook edition of this title is Open Access and freely available to read online Smart Industry Better Management explores concepts in future proofing industrial and product systems use of cyber physical systems digitization interconnectivity and new manufacturing and product technologies

**Engineering Plant-Based Food Systems** Sangeeta Prakash,Bhesh

Bhandari,Claire Gaiani,2022-11-16 Engineering Plant Based Food Systems provides a comprehensive in depth understanding on the technologies used to create quality plant based foods This title helps researchers and food processors gain an understanding of the diverse aspects of plant based foods with a focus to meet the current consumers demand of alternatives to animal products This is a one stop source that provides maximum information related to plant based foods to food science researchers food engineers and food processing manufacturers This book will enhance their understanding of plant based protein sources their application product manufacturing and bioavailability In recent years the emphasis on minimizing environmental footprints climate change greenhouse gas emissions deforestation and loss of biodiversity and human health issues related to animal source food intakes has shifted the attention of researchers dietitians and health professionals from animal based diets to diets rich in plant based foods legumes nuts seeds Explores the plant sources available for extraction of proteins the various extraction methods and the quality and functionality of the extracted proteins Describes existing plant based foods such as beverages yogurts spreads fermented foods and meats Provides information related to various plant based functional components such as polyphenols phytosterols aromatics and essential oils etc

**Manufacturing**

**Engineering Handbook, Second Edition** Hwaiyu Geng, 2015-10-22 The new edition of this professional resource reveals how to optimize all aspects of the global manufacturing process to build the highest quality goods at the lowest price in the shortest possible time How can one apply technical and business knowledge to develop a strategic plan that delivers increased productivity quality sustainability reliability agility resilience and best practices with rapid time to production and value The answers are found in the fully updated new edition of Manufacturing Engineering Handbook The goal of this second edition is to provide the essential knowledge needed to build products with the highest quality at the lowest cost in the least amount of time by optimizing all aspects of the manufacturing process design development tools processes quality speed output safety and sustainability You will gain access to information on conventional and modern technologies manufacturing processes and operations management that will assist you in achieving these goals The book is written by a team of more than 100 internationally renowned manufacturing engineering experts and pared down from its original 1200 pages The new and vastly improved second edition is specifically designed to concisely and succinctly cover traditional manufacturing processes and advanced technologies as well as newer manufacturing software and systems to integrate them into the modern global manufacturing world Brand new chapters on eco design and sustainability nano materials and nano manufacturing facilities planning operations research New sections on plastics composites and moldmaking global manufacturing and supply chain management Increased coverage of Design for Six Sigma and adaptive manufacturing Affiliated web site with color illustrations graphs charts discussions on future trends additional technical papers and suggestions for further reading

**Additive Manufacturing (3 D Printing)** Tafadzwa A. Magaya, 2017 3D printing additive manufacturing has been around for more than 30 years A lot of technological progress has been made in that time most recently with new innovations such as metal 3D printing Although the technology seems to hold a lot of promise the rate of adoption has not lived up to the hype The aim of this thesis is to research what has stopped 3D printing from catching on faster What factors are hindering large scale adoption for mass production We apply the Iterating to Insights framework to analyze technology limitations market dynamics business models and industry structure and to develop strategic insights that are surprising yet compelling Our end goal was to develop a set of insights that can be used by an investor in a 3D printing company to evaluate whether an application or market being pursued by a potential investment is worthwhile or not

Business Models with Additive Manufacturing ; Opportunities and Challenges from the Perspective of Economics and Management Frank T. Piller, Christian Weller, Robin Kleer, 2014

*Multi-material Additive Manufacturing* Ajit Behera, Tuan Anh Nguyen, 2025-04-18 Multi material Additive Manufacturing Processing Properties Opportunities and Challenges outlines various methods for the additive manufacturing of multi material polymers metals ceramics and metal ceramics showing readers how to tailor these materials with specific properties and specialized applications The first section of the book discusses the role of machine and process parameters the selection of raw materials interface control thermodynamic

calculations and process simulations The second section covers additive manufacturing techniques for multi materials and the book concludes with a section covering the different multi materials that can be produced and their various applications such as in electronics biomedical engineering and high end mechanical instruments Provides methods for additive manufacturing in multi material polymers metals ceramics composites and metal ceramics Discusses machine and process parameters raw materials thermodynamics of multi materials and applications of multi materials Weighs the pros and cons of various multi materials and their manufacturing processes

*Advances in Additive Manufacturing* Sandip Kumar, Jagadeesha T, S. Rama Sree, K. V. S. R. Murthy, M. Sreenivasa Reddy, 2024-09-17 This volume focuses on the fundamentals of additive manufacturing and its components explains why and what we do outlines what is crucial to the user offers details on important applications such as in the aerospace automotive or medical areas and the difficult certification process This book explores the advancements in additive manufacturing which produces solid free form nearly net shaped objects This refers to items that are easy to use out of the box and not bound by the design constraints of modern manufacturing techniques AM expands the definition of 3D printing to encompass a variety of procedures that begin with a three dimensional computer model incorporate an AM production procedure and result in a useful product The AM process can be confusing due to the rapid rise of competing techniques for fabricating 3D parts This volume provides a thorough review of the basic components and procedures involved in additive manufacturing It outlines a road map for where to begin what to study how everything goes together and how AM might enable ideas outside traditional processing to realize those ideas in AM Furthermore this book investigates the benefits of AM including affordable access to 3D solid modeling software With this software learning is achieved without having to invest in costly industrial equipment AM encompasses a variety of techniques including those that use high intensity beams to fuse powder or wire and hybrid techniques that combine additive and subtractive manufacturing techniques AM related processes have developed at breakneck speed giving rise to a deluge of acronyms and terminology not to mention the emergence acquisition and demise of new businesses By combining ideas and aspirations better methods will be revealed that result in useful products that will serve and contribute to a lasting future Although expensive commercial additive manufacturing equipment can cost hundreds of thousands to millions of dollars a lack of access to equipment does not preclude the study of the technology 3D printing services will undoubtedly become more reasonable for small and medium sized organizations as their prices decline Hybrid 3D plastic printing technologies and low cost hobbyist 3D weld deposition systems are already in development which will make the best 3D printers accessible and affordable This book will assist the reader in determining what is required to begin which software supplies and procedures best suit and where to obtain additional information Audience The book will be used by engineers and R D researchers involved in advanced additive manufacturing technology postgraduate students in various disciplines such as mechanical manufacturing biomedical and industrial engineering etc It will also serve as a reference manual for manufacturing and materials engineers

involved in additive manufacturing and product development      Additive Manufacturing (AM) Albert Thornton,2015 The introduction of additive manufacturing or 3D printing has brought about a whole new dimension of possibilities in manufacturing technology This book includes research on powder bed electron beam additive manufacturing EBAM which has the potential to offer innovative solutions to many challenges facing the manufacturing industry The feasibility of the use of a 3D printer to recreate patient specific anatomical modelling in this case of the pelvic rim are also examined A discussion on why the use of this technology to customise implants plates and the operative procedure to a patient s unique anatomy leads to improved outcomes is led by the authors The third chapter deals with selective laser melting SML and presents a review regarding the state of the art mechanical performance of the SML manufactured titanium and aluminium alloys due to wide demand of light weight parts in the aerospace and automotive industries The authors of the fourth chapter discuss the feasibility of mobile additive manufacturing systems powered by photovoltaic modules for different applications The book concludes with a review on functionally graded materials FGM which can be produced by laser metal deposition which belongs to the class of additive manufacturing LMD is capable of producing three dimensional 3D parts directly from the 3D image by adding materials layer by layer In this chapter laser metal deposition of titanium alloy composite are described and also characterised      Modern Plastics Worldwide ,2005      Union Agriculturist and Western Prairie Farmer ,2005

**Building the Future** Barrett Williams,ChatGPT,2025-02-05 Step into the future of manufacturing with Building the Future a groundbreaking exploration of how additive manufacturing and intelligent technologies are revolutionizing industries across the globe This enlightening eBook navigates through the intricate landscape of 3D printing revealing its transformation from a prototyping tool to a powerful production process intertwined with AI and machine learning Uncover the origins of additive manufacturing and witness its evolution as we delve into the sophisticated platforms shaping today s technological frontier With detailed insights into the software and hardware systems that drive innovation you ll venture into the cutting edge realms of aerospace healthcare automotive and beyond where customization and efficiency redefine conventional paradigms Building the Future illuminates the role of design thinking in bringing imagination to life showcasing remarkable case studies that highlight innovative applications in diverse sectors Explore how additive manufacturing is reshaping the aerospace and defense industries by enhancing aerodynamics and accelerating supply chains Discover bioprinting breakthroughs revolutionizing healthcare and immerse yourself in the automotive world where rapid prototyping fuels the creation of next generation electric vehicles Embrace the era of mass customization as consumer products take center stage merging fashion with technology to create sustainable personalized experiences From reinventing housing with eco friendly architectural marvels to democratizing art through new mediums this eBook is a comprehensive guide to the endless possibilities of additive manufacturing Learn how emerging technologies are transforming education inspiring creativity within STEM curricula and preparing the next generation of innovators Explore strategies for businesses to



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"Flawless Execution: Use the Techniques. Flawless Execution: Use the Techniques and Systems ... Flawless Execution: Use  
the Techniques and Systems of America's Fighter Pilots to Perform at Your Peak and Win the Battles of the Business World.  
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Battles of the Business World. James D. Flawless Execution : Use the Techniques and Systems of ... Flawless Execution : Use  
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the American military's fighter pilots. At Mach 2, the instrument panel of an F-15 is screaming out ... Flawless Execution: Use  
the Techniques and Systems ... Nov 16, 2010 — Flawless Execution: Use the Techniques and Systems of America's Fighter  
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