

# Advanced Composite Materials For Automotive Applications Structural Integrity And Crashworthiness

**A. Marinò, V. Bucci**

Advanced Composite Materials for Automotive Applications Ahmed Elmarakbi, 2013-10-09 The automotive industry faces many challenges, including increased global competition, the need for higher-performance vehicles, a reduction in costs and tighter environmental and safety requirements. The materials used in automotive engineering play key roles in overcoming these issues: ultimately lighter materials mean lighter vehicles and lower emissions. Composites are being used increasingly in the automotive industry due to their strength, quality and light weight. *Advanced Composite Materials for Automotive Applications: Structural Integrity and Crashworthiness* provides a comprehensive explanation of how advanced composite materials, including FRPs, reinforced thermoplastics, carbon-based composites and many others, are designed, processed and utilized in vehicles. It includes technical explanations of composite materials in vehicle design and analysis and covers all phases of composite design, modelling, testing and failure analysis. It also sheds light on the performance of existing materials including carbon composites and future developments in automotive material technology which work towards reducing the weight of the vehicle structure. Key features: Chapters written by world-renowned authors and experts in their own fields Includes detailed case studies and examples covering all aspects of composite materials and their application in the automotive industries Unique topic integration between the impact, crash, failure, damage, analysis and modelling of composites Presents the state of the art in composite materials and their application in the automotive industry Integrates theory and practice in the fields of composite materials and automotive engineering Considers energy efficiency and environmental implications *Advanced Composite Materials for Automotive Applications: Structural Integrity and Crashworthiness* is a comprehensive reference for those working with composite materials in both academia and industry, and is also a useful source of information for those considering using composites in automotive applications in the future.

**Composite Materials in Design Processes** Giangiacomo Minak, 2021-09-02 The use of composite materials in the design process allows one to tailor a component's mechanical properties, thus reducing its overall weight. On the one hand, the possible combinations of matrices, reinforcements, and technologies provides more options to the designer. On the other hand, it increases the fields that need to be investigated in order to obtain all the information requested for a safe design.

This Applied Sciences Special Issue, “Composite Materials in Design Processes”, collects recent advances in the design methods for components made of composites and composite material properties at a laminate level or using a multi-scale approach.

**Advanced Functional Textiles and Polymers** Shahid Ul Islam, B. S. Butola, 2019-11-12 This book on advanced functional textiles and polymers will offer a comprehensive view of cutting-edge research in newly discovered areas such as flame retardant textiles, antimicrobial textiles, insect repellent textiles, aroma textiles, medical-textiles, smart textiles, and nano-textiles etc. The second part the book provides innovative fabrication strategies, unique methodologies and overview of latest novel agents employed in the research and development of functional polymers.

**Dynamic Response and Failure of Composite Materials** Valentina Lopresto, Ilaria Papa, Antonio Langella, 2023-04-24 This book gathers the latest advances and innovations in the field of dynamic loads and testing of composite materials and sandwich structures, as presented by international researchers and engineers at the International Symposium on Dynamic Response and Failure of Composite Materials (DRAF), held in Ischia, Italy, on June 21-24, 2022. Contributions include a wide range of topics such as low and high velocity impacts, smart composites, hull slamming, shock and blast, hail and bird impact, damage resistance and tolerance, failure mechanisms, composite structures, delamination and fractures, progressive damage modeling, micromechanics, ballistic impacts, ceramic and CMC, auxetic materials and structures, additive manufacturing, crashworthiness, green composites, and structural health monitoring.

**Materials, Design and Manufacturing for Lightweight Vehicles** P.K. Mallick, 2020-09-26 Materials, Design and Manufacturing for Lightweight Vehicles, Second Edition, features the requirements for processing each material type, explains the manufacture of different categories of components, and analyzes different component joining techniques. The properties of all materials, metals, polymers and composites currently used are included along with how each one influences structural design. The new edition also contains refinements to manufacturing processes in particular hot stamping of boron steel and aluminum alloy, and new chapters on designing lightweight automotive structures & lightweight materials for powertrains and electric vehicles. With its distinguished editor and renowned team of contributors, this is a standard reference for practicing engineers involved in the design and material selection for motor vehicle bodies and components as well as material scientists, environmental scientists, policy makers, car companies and automotive component manufacturers. - Fully updated including emphasis on optimized production methods for steels, aluminum alloys, polymers and polymer composite - Covers aspects related to the production of environmentally acceptable leading-edge automobiles - Explores the manufacturing process for light alloys including metal forming processes for automotive applications as well as new developments in steel technology that are making advanced high strength steels more attractive for lightweight vehicles

Lightweight and Sustainable Materials for Automotive Applications Omar Faruk, Jimi Tjong, Mohini Sain, 2017-06-01

Automotive manufacturers are required to decrease CO<sub>2</sub> emissions and increase fuel economy while assuring driver comfort and safety. In recent years, there has been rapid development in the application of lightweight and sustainable materials in the automotive industry to help meet these criteria. This book provides critical reviews and the latest research results of various lightweight and sustainable materials in automotive applications. It discusses current applications and future trends of lightweight materials in the automotive area. While there are a few books published mainly focusing on automotive applications of metallic lightweight materials, to date there is no available book focusing on a broad spectrum of lightweight materials, including metal, plastic, composites, bio-fiber, bio-polymer, carbon fiber, glass fiber, nanomaterials, rubber materials, and foaming materials, as this work does. The book also includes case studies of commercial lightweight automotive parts from sustainable lightweight materials, providing an invaluable resource to those involved in this in-demand research and commercialization area.

**Lightweight and Sustainable Composite Materials** Sanjay Mavinkere Rangappa, Sunita M. Doddamani, Mrityunjay Doddamani, Suchart Siengchin, 2023-07-31 *Lightweight and Sustainable Composites Materials: Preparation, Properties and Applications* focuses on the synthesis, processing and characterization of these materials, their environmental sustainability features, compatibility with composites and their broad range of commercial and industrial application fields. The combination of being both lightweight and sustainable results in unique properties that make them suitable for a broad range of advanced commercial engineering applications. The book will be a valuable reference resource for academic and industrial researchers and material scientists and engineers working in the development of lightweight and sustainable composite materials. As recent studies on these materials reveal that they possess excellent mechanical, electrical and thermal properties as well as improving environmental sustainability, this book is a welcomed resource. - Discusses recycling and lifecycle assessment - Covers different types of lightweight materials, including polymers, metals and natural fibers - Covers synthesis and characterization techniques - Links production, properties and applications with sustainability behavior - Considers future trends and challenges for lightweight and sustainable composite materials

Fiber Reinforced Polymeric Materials and Sustainable Structures Shamsher Bahadur Singh, Muthukumar Gopalarathnam, Venkatesh Kumar R. Kodur, Vasant A. Matsagar, 2023-03-01 This book deals with the introduction of various kinds of advanced composite materials such as carbon fiber-reinforced polymer (CFRP), glass fiber-reinforced polymer (GFRP), aramid fiber-reinforced polymer (AFRP), and basalt fiber-reinforced polymer (BFRP). This book covers the advantages and disadvantages of these advanced composite materials. The primary advantages, such as high specific strength and stiffness, of advanced composite materials result in lighter and durable structures. On the other hand, its linear elastic behavior till failure has been highlighted as the main disadvantage for their structural applications. This book also highlights the various forms in which the FRP components are tailored and stacked up to optimize its strength and stiffness

to deliver the high-performance structural as well as non-structural components in its real-life application. The various forms in which FRP materials are developed are described such as uni-directional, cross-ply, angle-ply, hybrid, and functionally graded composites. In addition, various forms in which these materials stacked and/ bonded to fabricate the various structural and non-structural components are described. Most importantly, techniques to extract plant-based cellulosic fibers and its application to fabricate the various forms of sustainable composite products are described. In addition, development of nano-particle-enforced cellulosic fibers for sustainable industrial products has also been presented. Furthermore, the use of advanced composites and natural fiber-based composites has been demonstrated for repair, rehabilitation, and retrofitting of deficient structural systems. Moreover, the comprehensive overview of the state-of-the-art research on the test methods for material characterization at room and elevated temperature is presented which will be of high interest to scientists, researchers, students, and engineers working in the fields of composite materials such as FRPs and other forms of composites such as fiber-reinforced concrete (FRC). This book is also helpful for undergraduate, masters, and most importantly Ph.D. research scholars for developing their fundamental understanding on advanced composite materials and their applications in construction as well as industrial sectors.

Composites Science, Technology, and Engineering Frank R. Jones,2022-04-21 Understand critical principles of composites with this interdisciplinary text. Covering such topics as design of durable structures, choice of fibre, matrix, manufacturing process and mechanics, it is an essential guide for scientists and engineers wishing to discover the benefits of composite materials for designing strong and durable structures.

**Design and Analysis of Composite Structures for Automotive Applications** Vladimir Kobelev,2019-04-01 A design reference for engineers developing composite components for automotive chassis, suspension, and drivetrain applications This book provides a theoretical background for the development of elements of car suspensions. It begins with a description of the elastic-kinematics of the vehicle and closed form solutions for the vertical and lateral dynamics. It evaluates the vertical, lateral, and roll stiffness of the vehicle, and explains the necessity of the modelling of the vehicle stiffness. The composite materials for the suspension and powertrain design are discussed and their mechanical properties are provided. The book also looks at the basic principles for the design optimization using composite materials and mass reduction principles. Additionally, references and conclusions are presented in each chapter. **Design and Analysis of Composite Structures for Automotive Applications: Chassis and Drivetrain** offers complete coverage of chassis components made of composite materials and covers elastokinematics and component compliances of vehicles. It looks at parts made of composite materials such as stabilizer bars, wheels, half-axes, springs, and semi-trail axles. The book also provides information on leaf spring assembly for motor vehicles and motor vehicle springs comprising composite materials. Covers the basic principles for the design optimization using composite materials and mass reduction principles Evaluates the vertical, lateral, and roll

stiffness of the vehicle, and explains the modelling of the vehicle stiffness Discusses the composite materials for the suspension and powertrain design Features closed form solutions of problems for car dynamics explained in details and illustrated pictorially Design and Analysis of Composite Structures for Automotive Applications: Chassis and Drivetrain is recommended primarily for engineers dealing with suspension design and development, and those who graduated from automotive or mechanical engineering courses in technical high school, or in other higher engineering schools.

Fatigue of Textile Composites Valter Carvelli, Stepan V Lomov, 2015-05-16 Fatigue of Textile Composites provides a current, state-of-art review on recent investigations on the fatigue behavior of composite materials, mainly those reinforced with textiles. As this particular group of composite materials is extremely important for a wide variety of industrial applications, including automotive, aeronautical, and marine, etc., mainly due to their peculiarities and advantages with respect to unidirectional laminated composites, the text presents comprehensive information on the huge variety of interlacement geometric architectures that are suitable for a broad range of different applications, their excellent drapability and versatility, which is highly important for complex double-curvature shape components and three-dimensional woven fabrics without plane reinforcement, and their main mechanical characteristics which are currently in high demand from industry. - Presents the current state-of-the-art investigations on fatigue behavior of composite materials, mainly those reinforced with textiles - Contains invaluable information pertaining to a wide variety of industries, including automotive, aeronautical, and marine, amongst others - Provides comprehensive information on the huge variety of interlacement geometric architectures that are suitable for a broad range of different applications

*Synthetic and Mineral Fibers, Their Composites and Applications* Sanjay Mavinkere Rangappa, Vinod Ayyappan, Gaurav Manik, Suchart Siengchin, 2024-07-25 Synthetic and Mineral Fibers, Their Composites and Applications reviews recent advances and technological developments in this important research field. The book provides an up-to-date record of significant research findings and observations along with an update on current and future potential applications. The book provides vital information on recent advancements, modern processing technologies, manufacturing, and applications and summarizes lifecycle and performance parameters for these types of composites. This book will be a valuable reference resource for academic and industrial researchers and materials scientists and engineers working in the development of polymer composite materials reinforced with synthetic and mineral fibers for applications in aerospace, medical, defense, automotive and construction sectors. - Covers both synthetic and mineral fibers, their composites, and applications - Highlights recent advances in mineral fiber- reinforced polymer composites, modern processing methods, and functionalization - Provides updates on hybrid (combination of both synthetic and mineral fiber) composite technologies - Features applications in aerospace, medical, defense and the construction industries

*Advances in Engine Tribology* Vikram Kumar, Avinash Kumar Agarwal, Ashutosh Jena, Ram Krishna Upadhyay, 2021-12-09

This book focuses on novel materials for advanced engine design. It includes the study of friction, wear, lubrication, suitable lubricant additives, and durability of different engine components of alcohol/biodiesel fueled engines. The contents highlight different lubrication systems to overcome friction and wear problems of automotive transportation systems. It also discusses different materials for future applications, wear of wheels and axels of locomotives, friction-induced noise and vibration and tribological behavior of texture surfaces in the automotive transport sector. This book will be of interest to those in academia and industry involved in alternative fuels application in IC engines, friction and wear study of various engine components, lubrication approaches and different additives of lubricants, and novel materials for advanced engine design.

**Automotive Manufacturing Processes** G.K. Awari,V.S. Kumbhar,R.B. Tirpude,S.W. Rajurkar,2023-07-14 Automotive Manufacturing Processes discusses basic principles and operational procedures of automotive manufacturing processes, issues in the automotive industry like material selection, and troubleshooting. Every chapter includes specific learning objectives, multiple-choice questions to test conceptual understanding of the subject and put theory into practice, review questions, solved problems, and unsolved exercises. It covers important topics including material decision-making processes, surface hardening processes, heat treatment processes, effects of friction and velocity distribution, the metallurgical spectrum of forging, and surface finishing processes. Features: Discusses automotive manufacturing processes in a comprehensive manner with the help of applications. Provides case studies addressing issues in the automotive industry and manufacturing operations in the production of vehicles. Discussion on material properties while laying emphasis on the materials and processing parameters. Covers applications and case studies of the automotive industry. The text will be useful for senior undergraduates, graduate students and academic researchers in areas including automobile engineering, industrial and manufacturing engineering and mechanical engineering.

*High Performance Technical Textiles* Roshan Paul,2019-04-29 An authentic resource for the fundamentals, applied techniques, applications and recent advancements of all the main areas of technical textiles Created to be a comprehensive reference, High Performance Technical Textiles includes the review of a wide range of technical textiles from household to space textiles. The contributors—noted experts in the field from all the continents—offer in-depth coverage on the fibre materials, manufacturing processes and techniques, applications, current developments, sustainability and future trends. The contributors include discussions on synthetic versus natural fibres, various textile manufacturing techniques, textile composites and finishing approaches that are involved in the manufacturing of textiles for a specific high performance application. Whilst the book provides the basic knowledge required for an understanding of technical textiles, it can serve as a springboard for inspiring new inventions in hi-tech fibres and textiles. This important book: Contains a unique approach that offers a comprehensive understanding of the manufacturing and applications of technical textiles Includes a general

overview to the fundamentals, current techniques, end use applications as well as the most recent advancements Explores the current standards in the industry and the ongoing research in the field Offers a comprehensive and single source reference on the topic Written for academics, researchers and professionals working in textile and related industries, High Performance Technical Textiles offers a systematic, structured, logical and updated source of information for understanding technical textiles.

*Commercializing Biobased Products* Seth W. Snyder,2016 Biobased products offer substantial economic and environmental benefits, but understanding how to commercialize this requires a comprehensive look at the process, including feedstocks, technologies, product slate, supply chain, policy, financing, and environmental impact. Covering biobased products in a broad context, this book examines the environmental and economic impacts, compares US and EU policies, explores the factors affecting financing, and considers biological conversion, catalytic conversion, and separations. By examining the process from several critical perspectives in the supply chain, this book provides chemical engineers with a better understanding of challenges, opportunities, risks, and benefits of commercialization.

**Proceedings of the American Society for Composites 2014-Twenty-ninth Technical Conference on Composite Materials** Hyonny Kim,D. Whisler,Z.M. Chen,C. Bisagni,M. Kawai,R. Krueger,2014-09-17 New and not previously published U.S. and international research on composite and nanocomposite materialsFocus on health monitoring/diagnosis, multifunctionality, self-healing, crashworthiness, integrated computational materials engineering (ICME), and moreApplications to aircraft, armor, bridges, ships, and civil structures This fully searchable CD-ROM contains 270 original research papers on all phases of composite materials, presented by specialists from universities, NASA and private corporations such as Boeing. The document is divided into the following sections: Aviation Safety and Aircraft Structures; Armor and Protection; Multifunctional Composites; Effects of Defects; Out of Autoclave Processing; Sustainable Processing; Design and Manufacturing; Stability and Postbuckling; Crashworthiness; Impact and Dynamic Response; Natural, Biobased and Green; Integrated Computational Materials Engineering (ICME); Structural Optimization; Uncertainty Quantification; NDE and SHM Monitoring; Progressive Damage Modeling; Molecular Modeling; Marine Composites; Simulation Tools; Interlaminar Properties; Civil Structures; Textiles. The CD-ROM displays figures and illustrations in articles in full color along with a title screen and main menu screen. Each user can link to all papers from the Table of Contents and Author Index and also link to papers and front matter by using the global bookmarks which allow navigation of the entire CD-ROM from every article. Search features on the CD-ROM can be by full text including all key words, article title, author name, and session title. The CD-ROM has Autorun feature for Windows 2000 or higher products and can also be used with Macintosh computers. The CD includes the program for Adobe Acrobat Reader with Search 11.0. One year of technical support is included with your purchase of this product.

Advances in Mechanics of Time-Dependent Materials Holm Altenbach, Julius Kaplunov, Hongbing Lu, Masayuki Nakada, 2023-03-09 This book presents current trends in Mechanics of Time Dependent Materials. It covers a number of cutting-edge themes, such as characterization of linear and nonlinear mechanical behavior of viscoelastic materials and their composites, taking into consideration large deformations, low, moderate and large strain rates, as well as failure and fracture phenomena. The contributions are inspired by advanced applications in modern technologies, such as injection molding and extrusion.

Technology and Science for the Ships of the Future A. Marinò, V. Bucci, 2018-06-22 In 1974, a scientific conference covering marine automation group and large vessels issues was organized under the patronage of the Technical Naval Studies Centre (CETENA) and the Italian National Research Council (CNR). A later collaboration with the Marine Technical Association (ATENA) led to the renaming of the conference as NAV, extending the topics covered to the technical field previously covered by ATENA national conferences. The NAV conference is now held every 3 years, and attracts specialists from all over the world. This book presents the proceedings of NAV 2018, held in Trieste, Italy, in June 2018. The book contains 70 scientific papers, 35 technical papers and 16 reviews, and subjects covered include: comfort on board; conceptual and practical ship design; deep sea mining and marine robotics; protection of the environment; renewable marine energy; design and engineering of offshore vessels; digitalization, unmanned vehicles and cyber security; yacht and pleasure craft design and inland waterway vessels. With its comprehensive coverage of scientific and technical maritime issues, the book will be of interest to all those involved in this important industry.

**Multifunctionality of Polymer Composites** Klaus Friedrich, Ulf Breuer, 2015-05-21 Approx.964 pages

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