Elements Of Computer Aided Design And Manufacturing

Cet ouvrage collectif rassemble les recherches les plus récentes dans le domaine des interfaces homme-machine. Il fournit des conseils pratiques d'utilisation des différentes techniques CADUI afin de développer efficacement des interfaces utilisateur d'applications interactives.

This book constitutes the edited proceedings of the Advanced Studies Institute on Boundary Element Techniques in Computer Aided Engineering held at The Institute of Computational Mechanics, Ashurst Lodge, Southampton, England, from September 19 to 30, 1984. The Institute was held under the auspices of the newly launched "Double Jump Programme" which aims to bring together academics and industrial scientists. Consequently the programme was more industrially based than other NATO ASI meetings, achieving an excellent combination of theoretical and practical aspects of the newly developed Boundary Element Method. In recent years engineers have become increasingly interested in the application of boundary element techniques for the solution of continuum mechanics problems. The importance of boundary elements is that it combines the advantages of boundary integral equations (i.e. reduction of dimensionality of the problems, possibility of modelling domains extending to infinity, numerical accura'cy) with the versatility of finite elements (i.e. modelling of arbitrary curved surfaces). Because of this the technique has been well received by the engineering and scientific communities. Another important advantage of boundary elements stems from its reduction of dimensionality, that is that the technique requires much less data input than classical finite elements. This makes the method very well suited for Computer Aided Design and in great part explains the interest of the engineering profession in the new technique.

This state-of-the-art book explores the concept of knowledge-intensive CAD systems. The topics covered range from ontology to knowledge representation, making it essential reading for researchers, engineers, and technical managers involved in the development of advanced applications for knowledge management, engineering design, and manufacturing.

Control and Dynamic Systems, Volume 58: Computer-Aided Design/Engineering (CAD/CAE) Techniques and Their Applications Part 1 of 2 is the first of a two-volume sequence that manifests the significance and the power of CAD/CAE techniques that are available and their further development for the essential role they play in the design of modern engineering systems. The volume contains eight chapters and begins with a study on the reliability and control (limiting) of errors in the CAD/CAE design process. This is followed by separate chapters on methods for organizing engineering design and design techniques in a CAD/CAE database system; the various high-level tools to support a CAD engineer working in the graphical user interface computer environment; and finite element analysis techniques in the CAD/CAE process. Subsequent chapters deal with explicit and implicit aspects of large-scale nonlinear finite element analysis; techniques in parallel computing architectures; and a comprehensive treatment of (iterative) change in the design process. This volume will provide a significant and, perhaps, unique reference source for students, research workers, practicing engineers, and others on the international scene for many years.

The selection of the proper materials for a structural component is a critical activity that is governed by many, often conflicting factors. Incorporating materials expert systems into CAD/CAM operations could assist designers by suggesting potential manufacturing processes for particular products to facilitate concurrent engineering, recommending various materials for a specific part based on a given set of characteristics, or proposing possible modifications of a design if suitable materials for a particular part do not exist. This book reviews the structural design process, determines the elements, and capabilities required for a materials-selection expert system to assist design engineers, and recommends the areas of expert system and materials modeling research and development required to devise a materials-specific design system.

Co-published with Computational Mechanics Publications, UK. Papers presented at the Third International Conference on Computer Aided Technology Design in Composite Material Technology, University of Delaware, Newark, USA, May 1992.

In the competitive business arena companies must continually strive to create new and better products faster, more efficiently, and more cost effectively than their competitors to gain and keep the competitive advantage. Computer-aided design (CAD), computer-aided engineering (CAE), and computer-aided manufacturing (CAM) are now the industry standa

This book presents a study of computer-aided machine design and explains the fundamental concepts of kinematics and machine element design in lay terms. It is useful for those concerned with developing new programs in computer-aided design, in both industry and education.

Broad coverage of digital product creation, from design to manufacture and process optimization This book addresses the need to provide up-to-date coverage of current CAD/CAM usage and implementation. It covers, in one source, the entire design-to-manufacture process, reflecting the industry trend to further integrate CAD and CAM into a single, unified process. It also updates the computer aided design theory and methods in modern manufacturing systems and examines the most advanced computer-aided tools used in digital manufacturing. Computer Aided Design and Manufacturing consists of three parts. The first part on Computer Aided Design (CAD) offers the chapters on Geometric Modelling; Knowledge Based Engineering; Platforming Technology; Reverse Engineering; and Motion Simulation. The second part on Computer Aided Manufacturing (CAM) covers Group Technology and Cellular Manufacturing; Computer Aided Fixture Design; Computer Aided Manufacturing; Simulation of Manufacturing Processes; and Computer Aided Design of Tools, Dies and Molds (TDM). The final part includes the chapters on Digital Manufacturing; Additive Manufacturing; and Design for Sustainability. The book is also featured for being uniquely structured to classify and align engineering disciplines and computer aided technologies from the perspective of the design needs in whole product life cycles, utilizing a comprehensive Solidworks package (add-ins, toolbox, and library) to showcase the most critical functionalities of modern computer aided tools, and presenting real-world design projects and case studies so that readers can gain CAD and CAM problem-solving skills upon the CAD/CAM theory. Computer Aided Design and Manufacturing is an ideal textbook for undergraduate and graduate students in mechanical engineering, manufacturing engineering, and industrial engineering. It can also be used as a technical reference for researchers and engineers in mechanical and manufacturing engineering or computer-aided technologies.

CAD84: 6th International Conference and Exhibition on Computers in Design Engineering is a collection of 64 conference papers that covers a wide range of topics on computer-aided design (CAD) and CADCAM, including CAD process plant designs, techniques, drafting systems, electronics, geometric design, kinematics, mechanical engineering, solid modelling, and structures. The book starts by describing the progress that has been made in hardware and software. The text continues by presenting papers about interactive system for the design and production of computer programs; an algorithmic language for the definition and manipulation of drawings; and a software tool to enable application dialog input to be developed for new or existing programs with or without problem-oriented language. Papers on the design of a drawing system that consists of a language kernel for tailoring the system to support various styles and

practices and on an automated drawing and cost estimation program for platform frame construction named HOUSE24 are also presented. The book also discusses HILO-2, which is a single coherent system for design verification, fault simulation, and test vector generation. The text will benefit both students and professionals using CAD.

Describes facets of CAD/CAM. Illustrates how each is tied together in an integrated system. Serves as a text for college-level courses in mechanical or manufacturing engineering; for professional in-house training programs & seminars.

This manual helps engineers and manufacturers improve their knowledge of computer-aided manufacturing software (Pro/Manufacture). This manual—intended for those with some familiarity of Pro/Creo Elements or Pro/Engineer and a basic understanding of machining operations such as milling and turning when consulting this manual—includes numerous tutorials to help you improve your skills. The handbook guides the user to start with a part, create stock around the part, add tools to the list, create different machining sequences and in the end obtain G codes for different Computer Numerical Control machines. You will learn more about three-, four-, and five-axis milling along with two-axis turning. The simple, click-by-click procedure and numerous images make directions easy to follow. CAM software is rapidly evolving, and it's becoming more powerful every day. Anyone who wants to work in a CAM area must have a basic understanding of G and M codes to succeed in the field. Hone your skills and keep the process safe, precise and accurate with this detailed guidebook.

Manufacturing contributes to over 60 % of the gross national product of the highly industrialized nations of Europe. The advances in mechanization and automation in manufacturing of international competitors are seriously challenging the market position of the European countries in different areas. Thus it becomes necessary to increase significantly the productivity of European industry. This has prompted many governments to support the development of new automation resources. Good engineers are also needed to develop the required automation tools and to apply these to manufacturing. It is the purpose of this book to discuss new research results in manufacturing with engineers who face the challenge of building tomor row's factories. Early automation efforts were centered around mechanical gear-and-cam technology and hardwired electrical control circuits. Because of the decreasing life cycle of most new products and the enormous model diversification, factories cannot be automated efficiently any more by these conventional technologies. With the digital computer, its fast calculation speed and large memory capacity, a new tool was created which can substantially improve the productivity of manufactur ing processes. The computer can directly control production and quality assurance functions and adapt itself quickly to changing customer orders and new products.

This compact, up-to-date survey of CAD/CAM software and hardware presents the principles of interactive graphics and discusses the essential elements of computer-aided design and manufacturing. It contains numerous examples in both BASIC and FORTRAN languages, which can be run on the Tektronix 4050 series, IBM PC, Apple II, TRS-80, and other computer graphics systems.

The automotive industry faces constant pressure to reduce development costs and time while still increasing vehicle quality. To meet this challenge, engineers and researchers in both science and industry are developing effective strategies and flexible tools by enhancing and further integrating powerful, computer-aided design technology. This book provides a valuable overview of the development tools and methods of today and tomorrow. It is targeted not only towards professional project and design engineers, but also to students and to anyone who is interested in state-of-the-art computer-aided development. The book begins with an overview of automotive development processes and the principles of virtual product development. Focusing on computer-aided design, a comprehensive outline of the fundamentals of geometry representation provides a deeper insight into the mathematical techniques used to describe and model geometrical elements. The book then explores the link between the demands of integrated design processes and efficient data management. Within automotive development, the management of knowledge and engineering data plays a crucial role. Some selected representative applications provide insight into the complex interactions between computer-aided design, knowledge-based engineering and data management and highlight some of the important methods currently emerging in the field.

The impact of the technology of Computer-Aided Design and Manufacturing in automobile engineering, marine engineering and aerospace engineering has been tremendous. Using computers in manufacturing is receiving particular prominence as industries seek to improve product quality, increase productivity and to reduce inventory costs. Therefore, the emphasis has been attributed to the subject of CAD and its integration with CAM. Designed as a textbook for the undergraduate students of mechanical engineering, production engineering and industrial engineering, it provides a description of both the hardware and software of CAD/CAM systems. The Coverage Includes ? Principles of interactive computer graphics ? Wireframe, surface and solid modelling ? Finite element modelling and analysis ? NC part programming and computer-aided part programming ? Machine vision systems ? Robot technology and automated guided vehicles ? Flexible manufacturing systems ? Computer integrated manufacturing ? Artificial intelligence and expert systems ? Communication systems in manufacturing PEDAGOGICAL FEATURES ? CNC program examples and APT program examples ? Review questions at the end of every chapter ? A comprehensive Glossary ? A Question Bank at the end of the chapters

Computer graphics, computer-aided design, and computer-aided manufacturing are tools that have become indispensable to a wide array of activities in contemporary society. Euclidean processing provides the basis for these computer-aided design systems although it contains elements that inevitably lead to an inaccurate, non-robust, and complex system. The primary cause of the deficiencies of Euclidean processing is the division operation, which becomes necessary if an n-space problem is to be processed in n-space. The difficulties that accompany the division operation may be avoided if processing is conducted entirely in (n+1)-space. The paradigm attained through the logical extension of this approach, totally four-dimensional processing, is the subject of this book. This book offers a new system of geometric processing techniques that attain accurate, robust, and compact computations, and allow the construction of a systematically structured CAD system.

Elements of Computer-Aided Design and ManufacturingJohn Wiley & Sons Incorporated

MACHINE DESIGN WITH CAD AND OPTIMIZATION A guide to the new CAD and optimization tools and skills to generate real design synthesis of machine elements and systems Machine Design with CAD and Optimization offers the basic tools to design or synthesize machine elements and assembly of prospective elements in systems or products. It contains the necessary knowledge base, computer aided design, and optimization tools to define appropriate geometry and material selection of machine elements. A comprehensive text for each element includes: a chart, excel sheet, a MATLAB® program, or an interactive program to calculate the element geometry to guide in the selection of the appropriate material. The book contains an introduction to machine design and includes several design factors for consideration. It also offers information on the traditional rigorous design of machine elements. In addition, the author reviews the real design synthesis approach and offers material about stresses and material failure due to applied loading during intended performance. This comprehensive resource also contains an introduction to computer aided design and optimization. This important book: Provides the tools to perform a new direct design synthesis rather than design by a process of repeated analysis Contains a guide to knowledge-based design using CAD tools, software, and optimum component design for the new direct design synthesis of machine elements Allows for the initial suitable design synthesis in a very short time Delivers information on the utility of CAD and Optimization Accompanied by an online companion site including presentation files Written for students of engineering design, mechanical engineering, and automotive design. Machine Design with CAD and Optimization contains the new CAD and Optimization tools and defines the skills needed to generate real design synthesis of machine elements and systems on solid ground for better products and systems.

Advances in electronics, communications, and the fast growth of the Internet have made the use of a wide variety of computing devices an every day occurrence. These computing devices have different interaction styles, input/output techniques, modalities, characteristics, and contexts of use. Furthermore, users expect to access their data and run the same application from any of these devices. Two of the problems we encountered in our own work [2] in building VIs for different platforms were the different layout features and screen sizes associated with each platform and device. Dan Ol sen [13], Peter Johnson [9], and Stephen Brewster, et al. [4] all talk about problems in interaction due to the diversity of interactive platforms, devices, network services and applications. They also talk about the problems associ ated with the small screen size of hand-held devices. In comparison to desk top computers, hand-held devices will always suffer from a lack of screen real estate, so new metaphors of interaction have to be devised for such de vices. It is difficult to develop a multi-platform user interface (VI) without duplicating development effort. Developers now face the daunting task to build UIs that must work across multiple devices. There have been some ap proaches towards solving this problem of multi-platform VI development in cluding XWeb [14]. Building "plastic interfaces" [5,20] is one such method in which the VIs are designed to "withstand variations of context of use while preserving usability".

This book investigates the various aspects of shape optimization of two dimensional continuum structures, including shape design sensitivity analysis, structural analysis using the boundary element method (BEM), and shape optimization implementation. The book begins by reviewing the developments of shape optimization, followed by the presentation of the mathematical programming methods for solving optimization problems. The basic theory of the BEM is presented which will be employed later on as the numerical tool to provide the structural responses and the shape design sensitivities. The key issue of shape optimization, the shape design sensitivity analy sis, is fully investigated. A general formulation of stress sensitivity using the continuum approach is presented. The difficulty of the modelling of the ad joint problem is studied, and two approaches are presented for the modelling of the adjoint problem. The first approach uses distributed loads to smooth the concentrated adjoint loads, and the second approach employs the singu larity subtraction method to remove the singular boundary displacements and tractions from the BEM equation. A novel finite difference based approach to shape design sensitivity is pre sented, which overcomes the two drawbacks of the conventional finite difference method. This approach has the advantage of being simple in concept, and eas ier implementation. A shape optimization program for two-dimensional continuum structures is developed, including structural analysis using the BEM, shape design sensitiv ity analysis, mathematical programming, and the design boundary modelling.

Computer Aided Geometric Design covers the proceedings of the First International Conference on Computer Aided Geometric Design, held at the University of Utah on March 18-21, 1974. This book is composed of 15 chapters and starts with reviews of the properties of surface patch equation and the use of computers in geometrical design. The next chapters deal with the principles of smooth interpolation over triangles and without twist constraints, as well as the graphical representation of surfaces over triangles and rectangles. These topics are followed by discussions of the B-spline curves and surfaces; mathematical and practical possibilities of UNISURF; nonlinear splines; and some piecewise polynomial alternatives to splines under tension. Other chapters explore the smooth parametric surfaces, the space curve as a folded edge, and the interactive computer graphics application of the parametric bi-cubic surface to engineering design problems. The final chapters look into the three-dimensional human-machine communication and a class of local interpolating splines. This book will prove useful to design engineers. In this book, the author has presented an introduction to the practical application of some of the essential technical topics related to computer-aided engineering (CAE). These topics include interactive computer graphics (ICG), computer-aided design (CAD), computer and computer-integrated manufacturing (CIM). aided analysis (CAA) Unlike the few texts available, the present work attempts to bring all these seemingly specialised topics together and to demonstrate their integration in the design process through practical applications to real engineering problems and case studies. This book is the result of the author's research and teaching activities for several years of postgraduate and undergraduate courses in mechanical design of rotating machinery, computer-aided engineering, of finite elements, solid mechanics, engineering practical applications and properties of materials at Cranfield Institute of dynamics Technology, Oxford Engineering Science and the University of Manchester Institute of Science and Technology (UMIST). It was soon realised that no books on the most powerful and versatile tools available to

engineering designers existed. To satisfy this developing need, this book, on the use of computers to aid the design process and to integrate design, analysis and manufacture, was prepared. Computer-aided Design Techniques deals with the tools used in computer-aided design, problems associated with software development for design, and techniques applied in the development of the REDAC system. The book covers topics such as program design, requirements of a program for general use, and representation of the circuit in a computer; device modeling, general linear modeling, and linear and non-linear transistor modeling; and non-linear transient analysis. Also covered are topics such as layout capacitances and inductances computation; the use of graphic display as a drawing aid for circuit layout; and the writing of design programs. The text is recommended for engineers and physicists who would like to know how computers can aid them in design, as well as computer experts who aim to write programs intended for design.

In a society in which the use of information technology is becoming commonplace it is natural that pictures and images produced by elec tronic means should be increasing in importance as a means of com munication. Computer graphics have only recently come to the atten tion of the general public, mainly through animated drawings, advertise ments and video games. The quality of the pictures is often such that, unless informed of the fact, people are unaware that they are created with the help of computers. Some simulations, those developed in con nection with the space shuttle for example, represent a great and rapid progress. In industry, computer graphic techniques are used not only for the presentation of business data, but also in design and manufacture processes. Such computer-assisted systems are collectively represented by the acronym CAX. In CAD/CAM (computer-assisted design/manufacture), interactive graphic techniques have attained considerable importance. In CAD/CAM systems a dialogue can be established between the user and the machine using a variety of easy to operate communication devices. Due to the recent developments in hardware and software (for modelling, visual display, etc), a designer is now able to make decisions based on the information presented (plans, perspective drawings, graphics, etc) with the help of interactive, graphic techniques. These constitute the most visible and perhaps most spectacular aspect of CAD/CAM systems.

Beginning with the formulation of specific design problems, this book goes on explains theories of failure. It considers factors involved in optimization of design, followed by a detailed description of static, transient and dynamic analysis.

Shape interrogation is the process of extraction of information from a geometric model. It is a fundamental component of Computer Aided Design and Manufacturing (CAD/CAM) systems. This book provides a bridge between the areas geometric modeling and solid modeling. Apart from the differential geometry topics covered, the entire book is based on the unifying concept of recasting all shape interrogation problems to the solution of a nonlinear system. It provides the mathematical fundamentals as well as algorithms for various shape interrogation methods including nonlinear polynomial solvers, intersection problems, differential geometry of intersection curves, distance functions, curve and surface interrogation, umbilics and lines of curvature, and geodesics.

Many books already exist on computer-aided design and manufacture most of which are dedicated to describing the complexities of mathematical modelling and its application to industrial problems. In the experience of the present authors, however, if the subject is to be understood within its true, industrial context it must be taught in relation to the design process. Thus, while this book discusses both modelling and industrial applications, it also tries to provide an insight into design methodology, system selection and usage, and the social relationships that exist within design and manufacturing facilities. The teaching modules which make up the book are the distillation of material used by the authors both for undergraduate courses in CAD at Brunel University, and for seminars given to industrial users. The modules are not intended to be used in isolation, but rather to serve as an introductory survey which will enable students to grasp the broad outlines of the subject. Most aspects ofthe course presented here will need to be supported by further work and reading (see 'Further Reading'). In the authors' own courses much of the geometric and modelling work described in the text is supported by tutorial activities using the university department's commercial and research CAD/CAM systems. These include the Computervision-CADDS4X and Personal Systems.

Textbook

Computer-aided design has come of age in the magnetic devices industry. From its early beginnings in the 1960s, when the precision needs of the experimental physics community first created a need for computational aids to magnet design, CAD software has grown to occupy an important spot in the industrial designer's tool kit. Numerous commercial CAD systems are now available for magnetics work, and many more software packages are used in-house by large industrial firms. While their capabilities vary, all these software systems share a very substantial common core of both methodology and objec tives. The present need, particularly in medium-sized and nonspecialist firms, is for an understanding of how to make effective use of these new and immensely powerful tools: what approximations are inherent in the methods, what quantities can be calculated, and how to relate the com puted results to the needs of the designer. These new analysis techniques profoundly affect the designer's approach to problems, since the analytic tools available exert a strong influence on the conceptual models people build, and these in turn dictate the manner in which they formulate prob lems. The impact of CAD is just beginning to be felt industrially, and the authors believe this is an early, but not too early, time to collect together some of the experience which has now accumulated among industrial and research users of magnetics analysis systems.

Contents: Elements of computer aided design; Finite dimensional unconstrained optimization; Linear programming; Nonlinear programming and finite dimensional optimal design; Finite dimensional optimal structural design; The calculus of variations and optimal process theory; Optimal structural design by the indirect method; Methods of steepest descent for optimal design problems; Application of steepest descent methods to optimal structural design.

This volume of The Circuits and Filters Handbook, Third Edition focuses on computer aided design and design automation. In the first part of the book, international contributors address topics such as the modeling of circuit performances, symbolic analysis methods, numerical analysis methods, design by optimization, statistical design optimization, and physical design automation. In the second half of the text, they turn their attention to RF CAD, high performance simulation, formal verification, RTK behavioral synthesis, system-level design, an Internet-based micro-electronic design automation framework, performance modeling, and embedded computing systems design.

Optimize Designs in Less TimeAn essential element of equipment and system design, computer aided design (CAD) is commonly used to simulate potential engineering problems in order to

help gauge the magnitude of their effects. Useful for producing 3D models or drawings with the selection of predefined objects, Computer Aided Design: A Conceptual Appr