Computer Aided Engineering For Structural Analysis

This thesis presents two different applications of computer-aided non-destructive approaches for structures monitored under operational conditions. The first part of the thesis is the development of a graphical user interface (GUI) software for real-time autonomous assessment of structural health condition based on the signature vibration properties of the structure under study. The program, called ConImote2, operates on the wireless sensor network platform called imote2. ConImote2 is created in the Matlab platform for accessibility and to enable extension of its capabilities by the user. The primary goal of creating the program is to overcome the issue of data inundation from SHM systems by developing an autonomous data processing routine for instantaneous feedback on structural health conditions. Lab-scale validations of the program were used to fix bugs and provide important metrics about the sensitivity of the underlining algorithm to real changes in the structure. The second part of the thesis presents a new approach for optimum model selection during vibration-based finite element model updating of civil structures. The goal of this approach is to provide an evidence-based approach to model selection to ensure physical meaning in the non-unique optimum solutions obtained from a numerical optimization process. An algorithm is developed to rank the optimum solutions according to their physical plausibility. The algorithm uses data from static behavior of the structure to decouple the ranking algorithm from the vibration-based optimization algorithm. The approach is demonstrated on an in-service highway bridge instrumented with a sparse array of different sensors.

In December 1975, the Office, Chief of Engineers, approved a proposal to develop and conduct a unique experiment in instant dissemination, a participative conference. The objectives of the Conference were to produce a Corps-wide awareness of current capability in Computer-Aided Design in Structural Engineering (CADSE), identify short- and long-term needs, and recommend ways to meet those needs. This Conference was one of several experiments designed to test the value of research findings on how to enhance the dissemination of information. The Conference was needed because the developments in CADSE have taken place so rapidly that engineers have been unable to keep up with what is generally available or to coordinate what is to be done. The findings of the Conference are: The Corps has a few good programs; many more are needed, development should be on a Corps-wide basis; a Structural Engineering Software Center (SESC) is needed; and means for funding program development on a Corps-wide Bases must be found. The organizers analyzed the products of the Conference and recommended forming a permanent coordinating committee for Computer-Aided Structural Engineering (CASE) composed of one structural engineer from each Division Office and one Middle manager engineer (rotational yearly) from a District Office within each Division and members from Corps laboratories, as appropriate. The Committee, working under the Chief, Structures Branch, OCE, is to resolve the funding and SESC findings of the Conference and then proceed to guide long-term CADSE efforts on a Corps-wide basis.

Networking of personal computers and workstations is becoming commonplace in academic and industrial environments. A cluster of workstations provides engineers with a familiar, cost-effective environment for high performance computing. However, workstations often have no dedicated link and communicate slowly on a local area network (LAN), such as the Ethernet. Thus, to effectively harness the parallel processing or distributed computing capabilities of workstations, new algorithms need to be developed with a higher computation-to-communication ratio. Distributed Computer-Aided Engineering presents distributed algorithms for three fundamental areas: finite element analysis, design optimization, and visualization - providing a new direction in high performance structural engineering computing.

Product Performance Evaluation using CAD/CAE

Computer Aided Structural Engineering

Fundamentals of Computer-Aided Engineering

List of Computer Programs for Computer-Aided Structural Engineering

Computer-Aided Structural Engineering (CASE) Project: Computer-Aided Structural Modeling (CASM). Version 6.00, Report 5, Scheme C.

CASM stands for Computer Aided Structural Modeling. It is a program designed to aid the structural engineer in the preliminary design and evaluation of structural building systems by the use of 3-D interactive graphics. Think of this program as a scratch pad for the structural decision process that would have been done on paper before you went to the computer to do the final numerical analysis of structural members. CASM will let you change your mind quickly and give you results that previously might have taken hours to obtain. By allowing quick changes,

CASM allows you to make more informed decisions in the initial structural evaluation process. Mr. Charles Corns, in his speech on Structural Design in the Corps, spoke about the training of structural engineers, the responsibility of Office, Chief of Engineers (OCE), for issuing technical guidance to field offices, and the structural engineering research program. COL Patrick Marks, discussing Computer Support for Engineers, stressed OCE's willingness to help with hardware procurement, software support, research support dissemination efforts, contractual support, and ADP planning. Mr. Corns' second speech, The Role of Computers in Civil Works Design, gave the historical background for using the computer for structural analysis, surveyed the current Civil Works development program for computer use, and discussed some areas where computer analysis has vastly improved structural design. Mr. William D. Ashton, in his speech on Computer-Aided Bridge Design, told how the Rock Island District (RID) has greatly increased its design efficiency and reduced design time and costs by using the computer. Mr. James Cheek in his talk, Engineering Computer Graphics, gave the history of the Wes ADPC computer graphics capability. Dr. N. Radhakrishnan, discussed Some Recent Applications of the Finite Element Method In Corps' Work. Mr. Richard Delyea presented the Federal Construction Council's System called FACTS. A similar library called Conversationally Oriented Real-Time Programming System (CORPS) is maintained by the Corps of Engineers at WES.

Includes a selection of papers presented at the Sixth International Conference on Computing in Civil and Structural Engineering and the Fourth International Conference on the Application of Artificial Intelligence to Civil and Structural Engineering, held at Cambridge, England, 28-30 August, 1995.

Corps-Wide Conference on Computer-Aided Design in Structural Engineering. Volume II. List of Computer Programs for CADSE.

Computer Aided Optimal Design: Structural and Mechanical Systems

Innovative Computer-aided Structural Engineering

Computer Aided Design in Structural Engineering

Distributed Computer-Aided Engineering

This report contains a list of structural engineering and structures-related computer programs that are available with the U.S. Army Corps of Engineers. The list is arranged by structure-types and contains the computer program name, the author/contract person and office, library (if applicable), program number, computer and mode, information as to whether the program is documented or not, and a short description of the main objective of the program. Twenty-two structure groupings are provided and programs that fall in more than one subject category have been listed in all appropriate categories. (Author).

This book contains the edited version of lectures and selected papers presented at the NATO ADVANCED STUDY INSTITUTE ON COMPUTER AIDED OPTIMAL DESIGN: Structural and Mechanical Systems, held in Tr6ia, Portugal, 29th June to 11th July 1986, and organized by CEMUL -Center of Mechanics and Materials of the Technical University of Lisbon. The Institute was attended by 120 participants from 21 countries, including leading scientists and engineers from universities, research institutions and industry, and Ph.D. students. Some participants presented invited and contributed papers during the Institute and almost all participated actively in discussions on scientific aspects during the Institute. The Advanced Study Institute provided a forum for interaction among eminent scientists and engineers from different schools of thought and young reseachers. The Institute addressed the foundations and current state of the art of essential techniques related to computer aided optimal design of structural and mechanical systems, namely: Vari ational and Finite Element Methods in Optimal Design, Numerical Optimization Techniques, Design Sensitivity Analysis, Shape Optimal Design, Adaptive Finite Element Methods in Shape Optimization, CAD Technology, Software Development Techniques, Integrated Computer Aided Design and Knowledge Based Systems. Special topics of growing importance were also pre sented.

e-Design: Computer-Aided Engineering Design, Revised First Edition is the first book to integrate a discussion of computer design tools throughout the design process. Through the use of this book, the reader will understand basic design principles and all-digital design paradigms, the CAD/CAE/CAM tools available for various design related tasks, how to put an integrated system together to conduct All-Digital Design (ADD), industrial practices in employing ADD, and tools for product development. Comprehensive coverage of essential elements for understanding and practicing the e-Design paradigm in support of product design, including design method and process, and computer based tools and technology Part I: Product Design Modeling discusses virtual mockup of the product created in the CAD environment, including not only solid modeling and assembly theories, but also the critical design parameterization that converts the product solid model into parametric representation, enabling the search for better design alternatives Part II: Product Performance Evaluation focuses on applying CAE technologies and software tools to support evaluation of product performance, including structural analysis, fatigue and fracture, rigid body kinematics and dynamics, and failure probability prediction and reliability analysis Part III: Product Manufacturing and Cost Estimating introduces CAM technology to support manufacturing simulations and process planning, sheet forming simulation, RP technology and computer numerical control (CNC) machining for fast product prototyping, as well as manufacturing cost estimate that can be incorporated into product cost calculations Part IV: Design Theory and Methods discusses modern decision-making theory and the application of the theory to engineering design, introduces the mainstream design optimization methods for both single and multi-objectives problems through both batch and interactive design modes, and provides a brief discussion on sensitivity analysis, which is essential for designs using gradient-based approaches Tutorial lessons and case studies are offered for readers to gain hands-on experiences in practicing e-Design paradigm using two suites of engineering software: Pro/ENGINEER-based, including Pro/MECHANICA Structure, Pro/ENGINEER Mechanism Design, and Pro/MFG; and SolidWorks-based, including SolidWorks Simulation, SolidWorks Motion, and CAMWorks. Available on the companion website http://booksite.elsevier.com/9780123820389

Intelligent Computer-aided Teaching Systems for Structural Engineering

A Graphic Preprocessor for One-dimensional and Two-dimensional Finite Element Structures
The Implementation of a Computer Aided Design System for Steel Structural Engineering
Advanced Structural Analysis

(Cont.) This thesis examines the applications of computer software in the structural engineering industry, its effects both positive and negative, the professional and legal responsibility of engineers to use software wisely, methods of checking the results of computer analysis and design programs, recent innovations and the future of structural engineering computer software, and the importance of educating future structural engineers on the use of computer software. An examination of the drafting, structural analysis, and design of two complex structures using three-dimensional modeling programs is included to illustrate the value and correct use of structural engineering computer software. It is the intention of this thesis to highlight the benefits and dangers associated with the use of computer software in the structural engineering industry and to inspire innovations in the technology and capabilities of such software.

This report contains a list of structural engineering and structures-related computer programs that are available and recommended throughout the U.S. Army Corps of Engineers. The list provides the computer program name, the author and/or contact person and office, library (if applicable), program number, computer and mode, information as to whether the program has been documented or not, and a short description of what the program was written to accomplish. (Author).

Computer Aided EngineeringAdvanced Structural AnalysisCRC Press

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Enabling Technologies for Unified Life-Cycle Engineering of Structural Components
Contributions to Interactive Computer-aided Design in Structural Engineering
Computer-Aided Materials Selection During Structural Design
Computer-Aided Engineering Design

High-performance multiprocessor computers provide new and interesting opportunities to solve large-scale structural engineering problems. However, the development of new computational models and algorithms that exploit the unique architecture of these machines remains a challenge. High Performance Computing in Structural Engineering explores the use of supercomputers with vectorization and parallel processing capabilities in structural engineering applications. The book focuses on the optimization of large structures subjected to the complicated, implicit, and discontinuous constraints of commonly used design codes and presents robust parallel-algorithms for analysis of these structures. The authors apply the algorithms to and analyze the performance of minimum weight designs of large, steel space trusses and moment-resisting frames, with or without bracings, consisting of discrete standard shapes. They clearly show that adroit and judicious use of vectorization techniques can improved the speedup of an optimization algorithm, and that parallel processing can lead to even further speedup. With its review of the necessary background material, generous illustrations, and unique content, this is the definitive resource for the analysis and optimization of structure on shared-memory multiprocessor computers. By extension, High Performance Computing in Structural Engineering will prove equally valuable in distributed computing on a cluster of workstations

Unified life-cycle engineering (ULCE), or concurrent engineering, is a design engineering environment in which computer-aided design technology is used to assess and improve the quality of a product--not only during the active design phases but throughout its entire life cycle. This is achieved by integrating and optimizing the design attributes for producibility and supportability as well as for performance, operability, cost, and schedule. This book addresses ULCE approaches to design, manufacture, and application of structural components--especially for advanced military systems. Conclusions and recommendations to support the development of an effective ULCE design engineering environment are presented.

It is vital that today’s engineers work with computer-based tools and techniques. However, programming courses do not provide engineering students with the skills that are necessary to succeed in their professional career. Here, the authors propose a novel, practical approach that encompasses knowledge assimilation, decision-making capabilities and technical agility, together with concepts in computer-aided engineering that are independent of hardware and software technologies. This book: Outlines general concepts such as fundamental logic, definition of engineering tasks and computational complexity Covers numerous representation frameworks and reasoning strategies such as databases, objects, constraints, knowledge systems, search and optimisation, scientific computation and machine learning Features visualization and distribution of engineering information Presents a range of IT topics that are relevant to all branches of engineering Offers many practical engineering examples and exercises Fundamentals of Computer Aided Engineering provides support for all students involved in computer-aided engineering courses in civil, mechanical, chemical and environmental engineering. This book is also a useful reference for researchers, practising engineers using CAE and educators who wish to increase their knowledge of fundamental concepts.

Computer-Aided Structural Engineering (CASE) Project. Tutorial Guide: Computer-Aided Structural Modeling (CASM). Version 3.00
Computer-Aided Structural Engineering (CASE) Project: Computer-Aided Structural Modeling (CASM) Version 6.00. Report 1: Tutorial Guide
Corps-Wide Conference on Computer-Aided Design in Structural Engineering. Volume I. Management Report
Interactive Design and Optimization
Tutorial Guide: Computer-Aided Structural Modeling (CASM). Version 5.00

This is one book of a four-part series, which aims to integrate discussion of modern engineering design principles, advanced design tools, and industrial design practices throughout the design process. Through this series, the reader will: Understand basic design principles and modern engineering design paradigms. Understand CAD/CAE/CAM tools available for various design related tasks. Understand how to put an integrated system together to conduct product design using the paradigms and tools. Understand industrial practices in employing virtual engineering design and tools for product development. Provides a comprehensive and thorough coverage

on essential elements for product performance evaluation using the virtual engineering paradigms Covers CAD/CAE in Structural Analysis using FEM, Motion Analysis of Mechanical Systems, Fatigue and Fracture Analysis Each chapter includes both analytical methods and computer-aided design methods, reflecting the use of modern computational tools in engineering design and practice A case study and tutorial example at the end of each chapter provide hands-on practice in implementing off-the-shelf computer design tools Provides two projects at the end of the book showing the use of Pro/ENGINEER® and SolidWorks ® to implement concepts discussed in the book

This tutorial describes version 3.00 of the computer program CASM, which is designed to aid the structural engineer in the preliminary design and evaluation of structural building systems by the use of three-dimensional interactive graphics. CASM is a preliminary structural design program that incorporates a Structural Planning philosophy. Structural Planning is the study of structural system alternatives within the context of each project's unique set of program criteria. The goal of structural planning, and thus CASM, is to select the most appropriate, efficient, and economical structural system which satisfies established program criteria while integrating the mechanical requirements and complementing the intended aesthetics.

The Computer-Aided Structural Modeling (CASM) computer program is designed to aid the structural engineer in the preliminary design and evaluation of structural building systems by the use of three dimensional (3-D) interactive graphics. CASM allows the structural engineer to quickly evaluate various framing alternatives in order to make more informed decisions in the initial structural evaluation process. The program was developed by the Information Technology Laboratory in conjunction with the Computer-Aided Structural Engineering (CASE) Project, Building Systems Task Group.

The Computer Aided Engineering Design Series

Corps-wide Conference on Computer Aided Design in Structural Engineering, 22-26 September 1975

An Analytical Design and Structural Analyses of a New Electric Range Surface Unit Support Comparing Its Strength to an Existing Design, Applying Solid and Finite Element Modeling and Analyses, Verified by Simple Static Loading Experiments

Mechanical Computer Aided Engineering of Surface Unit Supports

Optimization of Structural Systems and Applications

The Computer-Aided Structural Modeling (CASM) computer program is designed to aid the structural engineer in the preliminary design and evaluation of structural building systems by the use of three-dimensional (3-D) interactive graphics. CASM allows the structural engineer to quickly evaluate various framing alternatives in order to make more informed decisions in the initial structural evaluation process. The program was developed by the Information Technology Laboratory in conjunction with the Computer Aided Structural Engineering (CASE) Project, Building Systems Task Group. This release of the CASM is designed to and the user with design criteria, building loads, and structural framing and design. The various parts of the program are summarized below: (a) Basic design criteria. The user can enter information directly or retrieve information from a user-definable database. The design criteria include information about the project, regional design information, and site-specific design information. (b) Building geometry. The user can assemble the building shape using 3-D primitives (cubes, prisms, spheres, cylinders, etc.) in an easy manner using pull-down menus, icons, and a mouse. (c) Dead and live loads. The user can select and construct dead and live loads from several user-definable menus of building materials and load conditions. These loads can then be applied to any desired area of the building volume. Building systems, Preliminary structural design, Computer Aided Structural Engineering (CASE), Structural modeling, 3-Dimensional interactive graphics, Computer programs, 3-Dimensional loads.

Very Good,No Highlights or Markup,all pages are intact.

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.

DELIGHT. STRUCT

Corps-Wide Conference on Computer-Aided Design in Structural Engineering. Volume III. Invited Speeches and Technical Presentations

Computer-aided Engineering Tools for Structural Health Monitoring Under Operational Conditions

A Computer-aided Design Environment for Structural Engineering

Corps-wide Conference on Computer Aided Design in Structural Engineering (CADSE). Volume 10: Stiffness Methods, Frames, and Military Engineering

This report describes the computer program CASM, which is designed to aid the structural engineer in the preliminary design and evaluation of structural building systems by the use of three dimensional interactive graphics, to describe the structural framing scheme for shear walls using monolithic concrete for a two story portion steel for the lower roof portion, and lateral load resistance.

Examines the new research on optimization taking place within the scientific community. Emphasis is placed on the numerous applications of the technique in industry for a variety of design problems in fields as diverse as offshore, mechanical, civil and aerospace engineering.

The Computer-Aided Structural Modeling (CASM) computer program is designed to aid the structural engineer in the preliminary design and evaluation of structural building systems by the use of three-dimensional (3-D) interactive graphics. CASM allows the structural engineer to quickly evaluate various framing alternatives in order to make more informed decisions in the initial structural evaluation process. The program was developed by the Information Technology Laboratory in conjunction with the Computer-Aided Structural Engineering (CASE) Project, Building Systems Task Group. This release of the CASM is designed to aid the user with design criteria, building loads, and structural

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e-Design

Computer-Aided Structural Engineering (CASE) Project. User's Guide: Computer-Aided Structural Modeling (CASM). Version 5.00

Computer-aided Engineering Methodology for Structural Optimization and Control

The Role of Computer-aided Drafting, Analysis, and Design Software in Structural Engineering Practice

High Performance Computing in Structural Engineering