Computational Structural Analysis And Finite Element Methods

Computational structural mechanics (CSM) and computational fluid dynamics (CFD) have emerged in the last two decades as new disciplines combining structural mechanics and fluid dynamics with approximation theory, numerical analysis and computer science. Their use has transformed much of theoretical mechanics and abstract science into practical and essential tools for a multitude of technological developments which affect many facets of our life. This collection of over 40 papers provides an authoritative documentation of major advances in both CSM and CFD, helping to identify future directions of development in these rapidly changing fields. Key areas covered are fluid structure interaction and aeroelasticity, CFD technology and reacting flows, micromechanics, stability and eigenproblems, probabilistic methods and chaotic dynamics, perturbation and spectral methods, element technology (finite volume, finite elements and boundary elements), adaptive methods, parallel processing machines and applications, and visualization, mesh generation and artificial intelligence interfaces.

BIM for Structural Engineering and Architecture Building Information Modeling:

Framework for Structural Design outlines one of the most promising new developments in architecture, engineering, and construction (AEC). Building information modeling (BIM) is an information management and analysis technology that is changing the role of computation in the architectural and engineering industries. The innovative process constructs a database assembling all of the objects needed to build a specific structure. Instead of using a computer to produce a series of drawings that together describe the building, BIM creates a single illustration representing the building as a whole. This book highlights the BIM technology and explains how it is redefining the structural analysis and design of building structures. BIM as a Framework Enabler This book introduces a new framework—the structure and architecture synergy framework (SAS framework)—that helps develop and enhance the understanding of the fundamental principles of architectural analysis using BIM tools. Based upon three main components: the structural melody, structural poetry, and structural analysis, along with the BIM tools as the frame enabler, this new framework allows users to explore structural design as an art while also factoring in the principles of engineering. The framework stresses the influence structure can play in form generation and in defining spatial order and composition. By highlighting the interplay between architecture and structure, the book

emphasizes the conceptual behaviors of structural systems and their aesthetic implications and enables readers to thoroughly understand the art and science of whole structural system concepts. Presents the use of BIM technology as part of a design process or framework that can lead to a more comprehensive, intelligent, and integrated building design Places special emphasis on the application of BIM technology for exploring the intimate relationship between structural engineering and architectural design Includes a discussion of current and emerging trends in structural engineering practice and the role of the structural engineer in building design using new BIM technologies Building Information Modeling: Framework for Structural Design provides a thorough understanding of architectural structures and introduces a new framework that revolutionizes the way building structures are designed and constructed.

Computational Structural Analysis and Finite Element MethodsSpringer Science & Business Media

STRUCTURAL ANALYSIS WITH THE FINITE ELEMENT METHOD Linear Statics Volume 1 : The Basis and Solids Eugenio Oñate The two volumes of this book cover most of the theoretical and computational aspects of the linear static analysis of structures with the Finite Element Method (FEM). The content of the book is based on the lecture notes of a basic course on Structural Analysis with

the FEM taught by the author at the Technical University of Catalonia (UPC) in Barcelona, Spain for the last 30 years. Volume1 presents the basis of the FEM for structural analysis and a detailed description of the finite element formulation for axially loaded bars, plane elasticity problems, axisymmetric solids and general three dimensional solids. Each chapter describes the background theory for each structural model considered, details of the finite element formulation and guidelines for the application to structural engineering problems. The book includes a chapter on miscellaneous topics such as treatment of inclined supports, elastic foundations, stress smoothing, error estimation and adaptive mesh refinement techniques, among others. The text concludes with a chapter on the mesh generation and visualization of FEM results. The book will be useful for students approaching the finite element analysis of structures for the first time, as well as for practising engineers interested in the details of the formulation and performance of the different finite elements for practical structural analysis. STRUCTURAL ANALYSIS WITH THE FINITE ELEMENT METHOD Linear Statics Volume 2: Beams, Plates and Shells Eugenio Oñate The two volumes of this book cover most of the theoretical and computational aspects of the linear static analysis of structures with the Finite Element Method (FEM).The content of the book is based on the lecture notes of a basic course on Structural Analysis

with the FEM taught by the author at the Technical University of Catalonia (UPC) in Barcelona, Spain for the last 30 years. Volume 2 presents a detailed description of the finite element formulation for analysis of slender and thick beams, thin and thick plates, folded plate structures, axisymmetric shells, general curved shells, prismatic structures and three dimensional beams. Each chapter describes the background theory for each structural model considered, details of the finite element formulation and guidelines for the application to structural engineering problems Emphasis is put on the treatment of structures with layered composite materials. The book will be useful for students approaching the finite element analysis of beam, plate and shell structures for the first time, as well as for practising engineers interested in the details of the formulation and performance of the different finite elements for practical structural analysis. Finite Element Analysis of Solids and Structures combines the theory of elasticity (advanced analytical treatment of stress analysis problems) and finite element methods (numerical details of finite element formulations) into one academic course derived from the author's teaching, research, and applied work in automotive product development as well as in civil structural analysis. Features Gives equal weight to the theoretical details and FEA software use for problem solution by using finite element software packages Emphasizes understanding

the deformation behavior of finite elements that directly affect the quality of actual analysis results Reduces the focus on hand calculation of property matrices, thus freeing up time to do more software experimentation with different FEA formulations Includes chapters dedicated to showing the use of FEA models in engineering assessment for strength, fatigue, and structural vibration properties Features an easy to follow format for guided learning and practice problems to be solved by using FEA software package, and with hand calculations for model validation This textbook contains 12 discrete chapters that can be covered in a single semester university graduate course on finite element analysis methods. It also serves as a reference for practicing engineers working on design assessment and analysis of solids and structures. Teaching ancillaries include a solutions manual (with data files) and lecture slides for adopting professors. Primarily intended for senior undergraduate and postgraduate students of civil, mechanical and aerospace/aeronautical engineering, this text emphasises the importance of reliability in engineering computations and understanding the process of computer aided engineering. Written with a view to promote the correct use of finite element technology and to present a detailed study of a set of essential computational tools for the practice of structural dynamics, this book is a ready-reckoner for an in-depth discussion of finite element theory and

estimation and control of errors in computations. It is specifically aimed at the audience with interest in vibrations and stress analysis. Several worked out examples and exercise problems have been included to describe the various aspects of finite element theory and modelling. The exercise on error analysis will be extremely helpful in grasping the essence of posteriori error analysis and mesh refinement. KEY FEATURES • Thorough discussion of numerical algorithms for reliable and efficient computation. • Ready-to-use finite element system and other scientific applications. • Tips for improving the quality of finite element solutions. • Companion DVD containing ready to use finite element applications. AUDIENCE: Senior Undergraduate and Postgraduate students of Civil, Mechanical and Aerospace/Aeronautical engineering

This book provides a solid introduction to the foundation and the application of the finite element method in structural analysis. It offers new theoretical insight and practical advice. This second edition contains additional sections on sensitivity analysis, on retrofitting structures, on the Generalized FEM (X-FEM) and on model adaptivity. An additional chapter treats the boundary element method, and related software is available at www.winfem.de.

This book presents theories and the main useful techniques of the Finite Element Method (FEM), with an introduction to FEM and many case studies of its use in

engineering practice. It supports engineers and students to solve primarily linear problems in mechanical engineering, with a main focus on static and dynamic structural problems. Readers of this text are encouraged to discover the proper relationship between theory and practice, within the finite element method: Practice without theory is blind, but theory without practice is sterile. Beginning with elasticity basic concepts and the classical theories of stressed materials, the work goes on to apply the relationship between forces, displacements, stresses and strains on the process of modeling, simulating and designing engineered technical systems. Chapters discuss the finite element equations for static, eigenvalue analysis, as well as transient analyses. Students and practitioners using commercial FEM software will find this book very helpful. It uses straightforward examples to demonstrate a complete and detailed finite element procedure, emphasizing the differences between exact and numerical procedures.

This book treats computational modeling of structures in which strong nonlinearities are present. It is therefore a work in mechanics and engineering, although the discussion centers on methods that are considered parts of applied mathematics. The task is to simulate numerically the behavior of a structure under various imposed excitations, forces, and displacements, and then to

determine the resulting damage to the structure, and ultimately to optimize it so as to minimize the damage, subject to various constraints. The method used is iterative: at each stage an approximation to the displacements, strains, and stresses throughout the structure is computated and over all times in the interval of interest. This method leads to a general approach for understanding structural models and the necessary approximations.

Two methods for solving linear systems of equations on the NAS Cray-2 are described. One is a direct method; the other is an iterative method. Both methods exploit the architecture of the Cray-2, particularly the vectorization, and are aimed at structural analysis applications. To demonstrate and evaluate the methods, they were installed in a finite element structural analysis code denoted the Computational Structural Mechanics (CSM) Testbed. A description of the techniques used to integrate the two solvers into the Testbed is given. Storage schemes, memory requirements, operation counts, and reformatting procedures are discussed. Finally, results from the new methods are compared with results from the initial Testbed sparse Choleski equation solver for three structural analysis problems. The new direct solvers described achieve the highest computational rates of the methods compared. The new iterative methods are not able to achieve as high computation rates as the vectorized direct solvers but are

best for well conditioned problems which require fewer iterations to converge to the solution. Poole, Eugene L. and Overman, Andrea L. Unspecified Center NAS1-18599; RTOP 505-63-01-10...

"Lectures presented at the Sixth International Conference on Computational Structures Technology, held in Prague, Czech Republic, in September 2002, are included in this book. Contributors include K. J. Bathe, Z. Bittnar, M. A. Bradford, B. Brank, C. Cinquini, D. Gawin, J. F. Hiller, A. Ibrahimbegovic, L. Jendele, M. Jirßsek, A. Kaveh, J. Korelc, W. B. KrStzig, T. Krejcf, J. Kruis, C. E. Majorana, C. A. Mota Soares, C. M. Mota Soares, G. Muscolino, T. Nouri-Baranger, D. Novßk, B. Patzßk, F. Pesavento, Y. S. Petryna, Y. L. Pi, M. A. Ramos Loja, B. A. Schrefler, J. Sejnoha, F. Stangenberg, M. Touratier, P. Venini, H. Zhang, and A. Zingoni. Topics include fluid-structure and fluid-solid interaction, linear and nonlinear finite element techniques, materials and fracture mechanics modeling, damage mechanics, analysis and design of composites and laminates, dynamic analysis, new techniques for structural mechanics, damage assessment techniques, and optimization in structural analysis and

Annotation This book fills a gap within the finite element literature by addressing the challenges and developments in multidiscipli-nary analysis. Current developments include disciplines of structural mechanics, heat transfer, fluid

mechanics, controls engineering and propulsion technology, and their interaction as encountered in many practical problems in aeronautical, aerospace, and mechanical engineering, among others. These topics are reflected in the 15 chapter titles of the book. Numerical problems are provided to illustrate the applicability of the techniques. Exercises may be solved either manually or by using suitable computer software. A version of the multidisciplinary analysis program STARS is available from the author. As a textbook, the book is useful at the senior undergraduate or graduate level. The practicing engineer will find it invaluable for solving full-scale practical problems.

Huge earthquakes and tsunamis have caused serious damage to important structures such as civil infrastructure elements, buildings and power plants around the globe. To quantitatively evaluate such damage processes and to design effective prevention and mitigation measures, the latest high-performance computational mechanics technologies, which include telascale to petascale computers, can offer powerful tools. The phenomena covered in this book include seismic wave propagation in the crust and soil, seismic response of infrastructure elements such as tunnels considering soil-structure interactions, seismic response of high-rise buildings, seismic response of nuclear power plants, tsunami run-up over coastal towns and tsunami inundation considering fluid-structure interactions. The book provides all necessary information for addressing these phenomena, ranging from the fundamentals of high-performance computing for finite element methods, key algorithms of accurate dynamic structural analysis,

fluid flows with free surfaces, and fluid-structure interactions, to practical applications with detailed simulation results. The book will offer essential insights for researchers and engineers working in the field of computational seismic/tsunami engineering.

Graph theory gained initial prominence in science and engineering through its strong links with matrix algebra and computer science. Moreover, the structure of the mathematics is well suited to that of engineering problems in analysis and design. The methods of analysis in this book employ matrix algebra, graph theory and meta-heuristic algorithms, which are ideally suited for modern computational mechanics. Efficient methods are presented that lead to highly sparse and banded structural matrices. The main features of the book include: application of graph theory for efficient analysis; extension of the force method to finite element analysis; application of meta-heuristic algorithms to ordering and decomposition (sparse matrix technology); efficient use of symmetry and regularity in the force method; and simultaneous analysis and design of structures.

Proper treatment of structural behavior under severe loading - such as the performance of a high-rise building during an earthquake - relies heavily on the use of probability-based analysis and decision-making tools. Proper application of these tools is significantly enhanced by a thorough understanding of the underlying theoretical and computational concepts as provided by this book. Detailing the computational aspects of stochastic analysis within the field of structural mechanics, this book first presents a few motivating examples that demonstrate the various random effects within the context of simple structural analysis models. It moreover briefly reviews the fundamental concepts from continuum mechanics and puts them in the perspective of modern numerical tools, such as the finite element method. More advanced

topics are developed step by step while gradually increasing the complexity of the structural and probabilistic analyses. This volume is intended for structural analysts and advanced students who wish to explore the benefits of stochastic analysis. It will provide researchers and decision makers working on structural and infrastructural systems with the necessary probabilistic information needed for strategic developments in construction, inspection and maintenance.

The usage and development of structural finite element processors based on the CSM Testbed's Generic Element Processor (GEP) template is documented. By convention, such processors have names of the form ESi, where i is an integer. This manual is therefore intended for both Testbed users who wish to invoke ES processors during the course of a structural analysis, and Testbed developers who wish to construct new element processors (or modify existing ones). Stanley, Gary M. and Nour-Omid, Shahram Unspecified Center NASA-CR-181728, NAS 1.26:181728, LMSC-D878511 NAS1-18444; RTOP 505-63-01-10...

The book teaches engineers many new things about a classical topic which suddenly is again in the center of interest because of its relevance for finite element analysis, for the accuracy of computational methods. It shows that influence functions play a fundamental role in the finite element analysis of structures and practically all of linear computational mechanics. It also strives to add new and important insights into modern structural analysis and into computational mechanics by establishing the central role of influence functions for the numerical analysis and to lay a new foundation to the energy and variational principles.

The increasing necessity to solve complex problems in Structural Dynamics and Earthquake Engineering requires the development of new ideas, innovative methods and numerical tools

for providing accurate numerical solutions in affordable computing times. This book presents the latest scientific developments in Computational Dynamics, Stochastic Dynam

The Finite Element Method for Solid and Structural Mechanics is the key text and reference for engineers, researchers and senior students dealing with the analysis and modeling of structures, from large civil engineering projects such as dams to aircraft structures and small engineered components. This edition brings a thorough update and rearrangement of the book's content, including new chapters on: Material constitution using representative volume elements Differential geometry and calculus on manifolds Background mathematics and linear shell theory Focusing on the core knowledge, mathematical and analytical tools needed for successful structural analysis and modeling, The Finite Element Method for Solid and Structural Mechanics is the authoritative resource of choice for graduate level students, researchers and professional engineers. A proven keystone reference in the library of any engineer needing to apply the finite element method to solid mechanics and structural design. Founded by an influential pioneer in the field and updated in this seventh edition by an author team incorporating academic authority and industrial simulation experience. Features new chapters on topics including material constitution using representative volume elements, as well as consolidated and expanded sections

on rod and shell models.

This second edition of the highly acclaimed and successful first edition, deals primarily with the analysis of structural engineering systems, with applicable methods to other types of structures. The concepts presented in the book are not only relevant to skeletal structures but can equally be used for the analysis of other systems such as hydraulic and electrical networks. The book has been substantially revised to include recent developments and applications of the algebraic graph theory and matroids.

Resoundingly popular in its first edition, the second edition of Mechanics of Structures: Variational and Computational Methods promises to be even more so, with broader coverage, expanded discussions, and a streamlined presentation. The authors begin by describing the behavior of deformable solids through the differential equations for the strength of materials and the theory of elasticity. They next introduce variational principles, including mixed or generalized principles, and derive integral forms of the governing equations. Discussions then move to computational methods, including the finite element method, and these are developed to solve the differential and integral equations. New in the second edition: A one-dimensional introduction to the finite element method, complete with illustrations of numerical mesh refinement Expansion of

the use of Galerkin's method. Discussion of recent developments in the theory of bending and torsion of thin-walled beams. An appendix summarizing the fundamental equations in differential and variational form Completely new treatment of stability, including detailed examples Discussion of the principal values of geometric properties and stresses Additional exercises As a textbook or as a reference, Mechanics of Structures builds a unified, variational foundation for structure mechanics, which in turn forms the basis for the computational solid mechanics so essential to modern engineering.

The Second Sino-US Symposium Workshop on Recent Advancement of Computational Mechanics in Structural Engineering was held between May 25-28, 1998, in Dalian, China. The objectives were: to share the insights and experiences gained from recent developments in theory and practice; to assess the current state of knowledge in various topic areas of mechanics and computational methods and to identify joint research opportunities; to stimulate future cooperative research and to develop joint efforts in subjects of common needs and interests; to build and to strengthen the long-term bilateral scientific relationship between academic and professional practicing communities. Topics discussed covered the entire field of computational structural mechanics. These topics have advanced broad applications in the engineering practice of modern

structural analysis, design and construction of buildings and other structures, and in natural hazard mitigation.

The finite element method (FEM) is a computational tool widelyused to design and analyse complex structures. Currently,there are a number of different approaches to analysis using theFEM that vary according to the type of structure being analysed:beams and plates may use 1D or 2D approaches, shells and solids 2Dor 3D approaches, and methods that work for one structure aretypically not optimized to work for another. Finite Element Analysis of Structures Through UnifiedFormulation deals with the FEM used for the analysis of themechanics of structures in the case of linear elasticity. Thenovelty of this book is that the finite elements (FEs) areformulated on the basis of a class of theories of structures knownas the Carrera Unified Formulation (CUF). It formulates 1D, 2D and3D FEs on the basis of the same 'fundamental nucleus' that comesfrom geometrical relations and Hooke's law, and presents both 1Dand 2D refined FEs that only have displacement variables as in 3Delements. It also covers 1D and 2D FEs that make use of 'real'physical surfaces rather than ’artificial’ mathematicalsurfaces which are difficult to interface in CAD/CAE software. Key features: Covers how the refined formulation can be easily andconveniently used to analyse laminated structures, such as sandwichand composite structures, and

to deal with multifield problems Shows the performance of different FE models through the 'besttheory diagram' which allows different models to be compared interms of accuracy and computational cost Introduces an axiomatic/asymptotic approach that reduces thecomputational cost of the structural analysis without affecting theaccuracy Introduces an innovative 'component-wise' approach to deal withcomplex structures Accompanied by a website hosting the dedicated software packageMUL2 (www.mul2.com) Finite Element Analysis of Structures Through UnifiedFormulation is a valuable reference for researchers andpractitioners, and is also a useful source of information forgraduate students in civil, mechanical and aerospaceengineering.

This document presents the operating policies and guidelines for the use of the Computational Structural Analysis Facilities (CSAF) within Air Vehicles Division (AVD). It has been created to assist users of the CSAF to perform professional, high quality finite element analysis (FEA). FE analysts from many tasks within AVD are using the facilities to conduct FEA with respect to the assessment of structural integrity and technical airworthiness of ADF aircraft. This document covers key issues such as data and resource management, as well as providing a comprehensive overview of the hardware and software facilities that are available for use. It also outlines recommended generic FEA modelling

procedures and provides an overview of key FEA manuals and references. The specific FEA application software that is covered includes MSC.Nastran, MSC.Patran, ABAQUS, PAFEC and PIGS.

In the years since the fourth edition of this seminal work was published, active research has developed the Finite Element Method into the pre-eminent tool for the modelling of physical systems. Written by the pre-eminent professors in their fields, this new edition of the Finite Element Method maintains the comprehensive style of the earlier editions and authoritatively incorporates the latest developments of this dynamic field. Expanded to three volumes the book now covers the basis of the method and its application to advanced solid mechanics and also advanced fluid dynamics. Volume Two: Solid and Structural Mechanics is intended for readers studying structural mechanics at a higher level. Although it is an ideal companion volume to Volume One: The Basis, this advanced text also functions as a "stand-alone" volume, accessible to those who have been introduced to the Finite Element Method through a different route. Volume 1 of the Finite Element Method provides a complete introduction to the method and is essential reading for undergraduates, postgraduates and professional engineers. Volume 3 covers the whole range of fluid dynamics and is ideal reading for postgraduate students and professional engineers working in this discipline. Coverage of the concepts necessary to model behaviour, such as viscoelasticity, plasticity and creep, as well as shells and plates.Up-to-date coverage of new linked interpolation methods for shell and plate formations.New material on non-linear geometry, stability and buckling of structures and large deformations.

A comprehensive treatment of the theory and practice of equilibrium finite element analysis in the context of solid and structural mechanics Equilibrium Finite Element Formulations is an up to date exposition on hybrid equilibrium finite elements, which are based on the direct approximation of the stress fields. The focus is on their derivation and on the advantages that strong forms of equilibrium can have, either when used independently or together with the more conventional displacement based elements. These elements solve two important problems of concern to computational structural mechanics: a rational basis for error estimation, which leads to bounds on quantities of interest that are vital for verification of the output and provision of outputs immediately useful to the engineer for structural design and assessment. Key features: Unique in its coverage of equilibrium – an essential reference work for those seeking solutions that are strongly equilibrated. The approach is not widely known, and should be of benefit to structural design and assessment. Thorough explanations of the formulations for: 2D and 3D continua, thick and thin bending of plates and potential problems; covering mainly linear aspects of behaviour, but also with some excursions into non-linearity. Highly relevant to the verification of numerical solutions, the basis for obtaining bounds of the errors is explained in detail. Simple illustrative examples are given, together with their physical interpretations. The most relevant issues regarding the computational implementation of this approach are presented. When strong equilibrium and finite elements are to be combined, the book is a must-have reference for postgraduate students, researchers in software development or numerical analysis, and industrial practitioners who want to keep up to date with progress in simulation tools.

This innovative approach to teaching the finite element method blends theoretical, textbook-

based learning with practical application using online and video resources. This hybrid teaching package features computational software such as MATLAB®, and tutorials presenting software applications such as PTC Creo Parametric, ANSYS APDL, ANSYS Workbench and SolidWorks, complete with detailed annotations and instructions so students can confidently develop hands-on experience. Suitable for senior undergraduate and graduate level classes, students will transition seamlessly between mathematical models and practical commercial software problems, empowering them to advance from basic differential equations to industry-standard modelling and analysis. Complete with over 120 end-of chapter problems and over 200 illustrations, this accessible reference will equip students with the tools they need to succeed in the workplace.

This extended and revised second edition is intended for engineering students and researchers working with finite element methods in structural and mechanical analysis. Discussing numerical structural analysis from first mechanical and mathematical principles, it establishes the central role of influence functions (Green's functions) in linear computational mechanics. The main features of the book are mentioned below. · Introducing Green's first and second identity as the core theorems of statics and mechanics. Formulation of the variational and energy principles of mechanics with an emphasis on the computational aspects and on the qualitative features of variational solutions. · Derivation of influence functions from duality principles, the distinction between weak and strong influence functions, the difference between monopoles and dipoles and how amputated dipoles lead to singularities, and how singularities on the boundary pollute the solution inside the domain - an unavoidable effect in 2-D and 3-D. · A detailed discussion of the various features of the finite element method and the key role of

the notion of "shake-equivalence" as originally introduced by Turner et alt. Establishing that in linear finite element analysis the accuracy depends on the accuracy of the influence functions. Introducing Betti extended as a core theorem of finite element analysis. · A systematic treatment of the role which Green's functions play in reanalysis, sensitivity analysis, parameter identification and in optimization. Explaining why averaging material parameters succeeds and how local stiffness changes can be identified with the action of equilibrium forces f+. · Presenting a new technique, one-click reanalysis, which allows to make modifications to a structure by clicking on single elements and seeing directly the new shape, bypassing the need to solve the modified system. · Four programs for the solution of the Poisson equation, 2-D elasticity, plate-bending problems and planar frames are offered for download in this second edition. These are all-purpose programs but with a particular emphasis on influence functions. The frame program also demonstrates one-click reanalysis.

Proceedings of Sino-US Joint Symposium/Workshop on Recent Developments and Future Trends of Computational Mechanics in Structural Engineering, Beijing, China, September 24-28 1991

Nowadays, numerical computation has become one of the most vigorous tools for scientists, researchers and professional engineers, following the enormous progress made during the last decades in computing technology, in terms of both computer hardware and software development. Although this has led to tremendous achievements in computer-based structural engineering, the increasing necessity of solving complex problems in engineering requires the development of new ideas and innovative methods for providing accurate numerical solutions in affordable computing times. This collection aims at providing a forum for the presentation

and discussion of state-of-the-art innovative developments, concepts, methodologies and approaches in scientific computation applied to structural engineering. It involves a wide coverage of timely issues on computational structural engineering with a broad range of both research and advanced practical applications. This Research Topic encompasses, but is not restricted to, the following scientific areas: modeling in structural engineering; finite element methods; boundary element methods; static and dynamic analysis of structures; structural stability; structural mechanics; meshless methods; smart structures and systems; fire engineering; blast engineering; structural reliability; structural health monitoring and control; optimization; and composite materials, with application to engineering structures.