



Central Mindanao University
College of Engineering
Civil Engineering Department
CE-33 Numerical Solutions to CE Problems

Long Quiz No.2
April 8, 2021

Instructions: Using A-4 or 8.5" x 11" size paper, solve the following neatly. Show all necessary solutions and assumptions clearly. Submit a scanned copy or a photo of your work in the Google classroom on or before the specified time.

1. Determine the approximate solution of the system of linear equations below using **Gauss- Seidel Iteration** after 8 iterations. Show all iterations/solutions. Provide a brief discussion of your solution.

$$\begin{cases} 5x_1 + x_2 + x_3 - x_4 + 2x_5 = 0.2B + 7 \\ x_1 - 6x_2 + x_3 + x_4 - 2x_5 = 0.1C - 4.5 \\ 2x_1 + x_2 - x_3 - 8x_4 + 2x_5 = 0.15D - 3.5 \\ 2x_1 + x_2 + 2x_3 - 2x_4 + 7x_5 = 0.3A + 3 \\ -x_1 + 2x_2 + 6x_3 - x_4 - x_5 = 14 - 0.1C \end{cases}$$

Assume: $\begin{bmatrix} x_1^{(0)} \\ x_2^{(0)} \\ x_3^{(0)} \\ x_4^{(0)} \\ x_5^{(0)} \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \\ 1 \end{bmatrix}$

2. A simply supported I-beam is loaded with a distributed load, as shown. The deflection, y , of the center line of the beam as a function of the position, x , is given by the equation:

$$y = \frac{w_0 x}{360EI} (7L^3 - 10L^2x^2 + 3x^4)$$

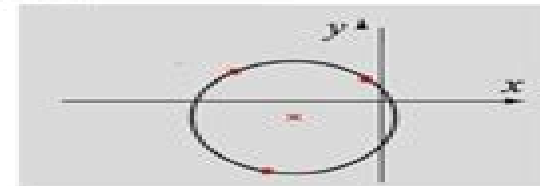


Where $L = (4.2 + 0.3C)$ m is the length, $E = (70 + 0.5D)$ GPa is the elastic modulus, $I = (52.9 + A) \times 10^{-6}$ m⁴ is the moment of inertia, and $w_0 = (18.5 + 0.5B)$ kN/m. Find the position x where the deflection of the beam is maximum, and determine the deflection at this point.

Hint: The maximum deflection is at the point where $dy/dx = 0$. Use **Newton - Raphson Method** with tolerance of 0.001. Provide a brief discussion of your solution.

3. In a Cartesian coordinate system the general equation of a circle is:

$$x^2 + y^2 + Dx + Ey + F = 0$$



Given three points, $\{(-1 + 0.1C), (3 + 0.5B)\}$, $\{(-7.5 + 0.1D), (4 - 0.2B)\}$, and $\{(-5.5 + 0.2C), (-9.2 + 0.4A)\}$. Determine the equation of the circle that passes through the points.

Solve the problem by deriving a system of three linear equations and solve the system using **Jacobi Iteration** up to 7 iterations and assume all initial values equal to 0.5. Provide a brief discussion of your solution.

Numerical Solution Of Field Problems In

Kay Hameyer, Ronnie Belmans



Numerical Solution Of Field Problems In:

Numerical Computation of Electric and Magnetic Fields Charles W. Steele, 2012-12-06 Since the first edition of this book was published in 1987 there have been several important changes in the state of numerical field computation as discussed in the Introduction These changes have motivated the publication of this second edition As with the first edition the objective of this second edition is to give the newcomer to field computation the information needed to perform practical field computations Again clarity of presentation is given greater emphasis than a high degree of sophistication or the state of the art And again the basic concepts of field computation are presented as well as the commonly used algorithms Several persons have provided much valuable information for this second edition I wish to thank Professor Giorgio Molinari of the University of Genoa Italy for advice regarding adaptive mesh generation Dr C R E Emson of Vector Fields Ltd England and Dr John Brauer of McNeal Schwendler Corp for their advice on transient eddy current computation and Dr Zoltan Cendes of Ansoft Corp for information about their adaptive mesh generator Again I would like to acknowledge the support for this second edition by my wife Candace Again I could not have written this book without her support NBS Special Publication

,1968 **Computational Electromagnetics for RF and Microwave Engineering** David B. Davidson, 2005-02-24 The numerical approximation of Maxwell's equations Computational Electromagnetics CEM has emerged as a crucial enabling technology for radio frequency microwave and wireless engineering The three most popular full wave methods the Finite Difference Time Domain Method the Method of Moments and the Finite Element Method are introduced in this book by way of one or two dimensional problems Commercial or public domain codes implementing these methods are then applied to complex real world engineering problems and a careful analysis of the reliability of the results obtained is performed along with a discussion of the many pitfalls which can result in inaccurate and misleading solutions The book will empower readers to become discerning users of CEM software with an understanding of the underlying methods and confidence in the results obtained It also introduces readers to the art of code development Aimed at senior undergraduate graduate students taking CEM courses and practising engineers in the industry Numerical Analysis of Electromagnetic Fields Pei-bai

Zhou, 2012-12-06 Numerical methods for solving boundary value problems have developed rapidly Knowledge of these methods is important both for engineers and scientists There are many books published that deal with various approximate methods such as the finite element method the boundary element method and so on However there is no textbook that includes all of these methods This book is intended to fill this gap The book is designed to be suitable for graduate students in engineering science for senior undergraduate students as well as for scientists and engineers who are interested in electromagnetic fields Objective Numerical calculation is the combination of mathematical methods and field theory A great number of mathematical concepts principles and techniques are discussed and many computational techniques are considered in dealing with practical problems The purpose of this book is to provide students with a solid background in

numerical analysis of the field problems The book emphasizes the basic theories and universal principles of different numerical methods and describes why and how different methods work Readers will then understand any methods which have not been introduced and will be able to develop their own new methods Organization Many of the most important numerical methods are covered in this book All of these are discussed and compared with each other so that the reader has a clear picture of their particular advantage disadvantage and the relation between each of them The book is divided into four parts and twelve chapters

The Finite Element Method in Electromagnetics Jian-Ming Jin, 2015-02-18 A new edition of the leading textbook on the finite element method incorporating major advancements and further applications in the field of electromagnetics The finite element method FEM is a powerful simulation technique used to solve boundary value problems in a variety of engineering circumstances It has been widely used for analysis of electromagnetic fields in antennas radar scattering RF and microwave engineering high speed high frequency circuits wireless communication electromagnetic compatibility photonics remote sensing biomedical engineering and space exploration The Finite Element Method in Electromagnetics Third Edition explains the method's processes and techniques in careful meticulous prose and covers not only essential finite element method theory but also its latest developments and applications giving engineers a methodical way to quickly master this very powerful numerical technique for solving practical often complicated electromagnetic problems Featuring over thirty percent new material the third edition of this essential and comprehensive text now includes A wider range of applications including antennas phased arrays electric machines high frequency circuits and crystal photonics The finite element analysis of wave propagation scattering and radiation in periodic structures The time domain finite element method for analysis of wideband antennas and transient electromagnetic phenomena Novel domain decomposition techniques for parallel computation and efficient simulation of large scale problems such as phased array antennas and photonic crystals Along with a great many examples The Finite Element Method in Electromagnetics is an ideal book for engineering students as well as for professionals in the field

Computer Literature Bibliography: 1964-1967 W. W. Youden, 1965

The Finite Element Method O. C. Zienkiewicz, R. L. Taylor, S. Govindjee, 2024-11-21 The Finite Element Method Its Basis and Fundamentals Eighth Edition offers a complete introduction to the basis of the finite element method covering fundamental theory and worked examples in a kind of detail required for readers to apply the knowledge to their own engineering problems and understand more advanced applications This edition includes a significant addition of content addressing coupling problems including Finite element analysis formulations for coupled problems Details of algorithms for solving coupled problems Examples showing how algorithms can be used to solve for piezoelectricity and poroelasticity problems Focusing on the core knowledge mathematical and analytical tools needed for successful application this book is the authoritative resource of choice for graduate level students researchers and professional engineers involved in finite element based engineering analysis Includes fully worked exercises throughout the book Addresses the formulation and

solution of coupled problems in detail Contains chapter summaries that help the reader keep up to speed **Applied Mechanics Reviews** ,1974 The Finite Element Method Set O. C. Zienkiewicz,R. L. Taylor,2005-11-25 The sixth editions of these seminal books deliver the most up to date and comprehensive reference yet on the finite element method for all engineers and mathematicians Renowned for their scope range and authority the new editions have been significantly developed in terms of both contents and scope Each book is now complete in its own right and provides self contained reference used together they provide a formidable resource covering the theory and the application of the universally used FEM Written by the leading professors in their fields the three books cover the basis of the method its application to solid mechanics and to fluid dynamics This is THE classic finite element method set by two the subject s leading authors FEM is a constantly developing subject and any professional or student of engineering involved in understanding the computational modelling of physical systems will inevitably use the techniques in these books Fully up to date ideal for teaching and reference The Langevin Equation William Coffey,Yu. P. Kalmykov,J. T. Waldron,1996 The book is suitable for a lecture course on the theory of Brownian motion being based on final year undergraduate lectures given at Trinity College Dublin Topics that are discussed include white noise the Chapman Kolmogorov equation Kramers Moyal expansion the Langevin equation the Fokker Planck equation Brownian motion of a free particle spectral density and the Wiener Khintchin theorem Brownian motion in a potential application to the Josephson effect ring laser gyro Brownian motion in two dimensions harmonic oscillators itinerant oscillators linear response theory rotational Brownian motion application to loss processes in dielectric and ferrofluids superparamagnetism and nonlinear relaxation processes As the first elementary book on the Langevin equation approach to Brownian motion this volume attempts to fill in all the missing details which students find particularly hard to comprehend from the fundamental papers contained in the Dover reprint Selected Papers on Noise and Stochastic Processes ed N Wax 1954 together with modern applications particularly to relaxation in ferrofluids and polar dielectrics **Boundary Elements and Other Mesh Reduction Methods** C.A. Brebbia,A.H-D Cheng,2018-02-01 Formed of presented papers this volume contains research from the 40th International Conference on Boundary Elements and other Mesh Reduction Methods recognised as THE international forum for the latest advances in these techniques and their applications in science and engineering The ongoing success of this series is a result of the strength of research being carried out all over the world and the coverage has continually evolved in line with the latest developments in the field The books originating from this conference series constitute a record of the development of BEM MRM running from the initial successful development of boundary integral techniques into the boundary element method a technique that eliminates the need for an internal mesh to the recent and most sophisticated Mesh Reduction and even Meshless Methods Since these methods are used in many engineering and scientific fields the 2017 book Boundary Elements and other Mesh Reduction Methods XXXX like the series before will be of great interest to those working within the areas of numerical analysis

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Finite Element Analysis David Moratal, 2010-08-17 Finite element analysis is an engineering method for the numerical analysis of complex structures This book provides a bird's eye view on this very broad matter through 27 original and innovative research studies exhibiting various investigation directions Through its chapters the reader will have access to works related to Biomedical Engineering Materials Engineering Process Analysis and Civil Engineering The text is addressed not only to researchers but also to professional engineers engineering lecturers and students seeking to gain a better understanding of where Finite Element Analysis stands today *Scientific and Technical Aerospace Reports*, 1993 Monthly Catalog of United States Government Publications, Cumulative Index United States. Superintendent of Documents, 1976

The Boundary Element Method A. Ali, C. Rajakumar, 2004-08-15 The Boundary Element Method or BEM is a powerful numerical analysis tool with particular advantages over other analytical methods With research in this area increasing rapidly and more uses for the method appearing this timely book provides a full chronological review of all techniques that have been proposed so far covering not only the funda

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environmental science as well as students of environmental engineering It also serves as a reference for engineers and scientists involved in the management regulation or restoration of freshwater environments **Monthly Catalog of United States Government Publications** ,1971 *Handbook of Software Solutions for ICME* Georg J. Schmitz,Ulrich Prah1,2016-09-20 As one of the results of an ambitious project this handbook provides a well structured directory of globally available software tools in the area of Integrated Computational Materials Engineering ICME The compilation covers models software tools and numerical methods allowing describing electronic atomistic and mesoscopic phenomena which in their combination determine the microstructure and the properties of materials It reaches out to simulations of component manufacture comprising primary shaping forming joining coating heat treatment and machining processes Models and tools addressing the in service behavior like fatigue corrosion and eventually recycling complete the compilation An introductory overview is provided for each of these different modelling areas highlighting the relevant phenomena and also discussing the current state for the different simulation approaches A must have for researchers application engineers and simulation software providers seeking a holistic overview about the current state of the art in a huge variety of modelling topics This handbook equally serves as a reference manual for academic and commercial software developers and providers for industrial users of simulation software and for decision makers seeking to optimize their production by simulations In view of its sound introductions into the different fields of materials physics materials chemistry materials engineering and materials processing it also serves as a tutorial for students in the emerging discipline of ICME which requires a broad view on things and at least a basic education in adjacent fields **Numerical Modelling and Design of Electrical Machines and Devices** Kay Hameyer,Ronnie Belmans,1999-05-21 This text provides an overview of numerical field computational methods and in particular of the finite element method FEM in magnetics Detailed attention is paid to the practical use of the FEM in designing electromagnetic devices such as motors transformers and actuators Based on the authors extensive experience of teaching numerical techniques to students and design engineers the book is ideal for use as a text at undergraduate and graduate level or as a primer for practising engineers who wish to learn the fundamentals and immediately apply these to actual design problems Contents Introduction Computer Aided Design in Magnetics Electromagnetic Fields Potentials and Formulations Field Computation and Numerical Techniques Coupled Field Problems Numerical Optimisation Linear System Equation Solvers Modelling of Electrostatic and Magnetic Devices Examples of Computed Models *Miscellaneous Publication - National Bureau of Standards* United States. National Bureau of Standards,1965

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