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## SIMULATION BASED ENGINEERING IN SOLID MECHANICS EBOOKS 2019



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This book begins with a brief historical perspective of the advent of rotating machinery in 20th century Solid Mechanics and the development of the discipline of the Strength of Materials. High Performance Computing (HPC) and Simulation Based Engineering Science (SBES) have gradually replaced the conventional approach in Design bringing science directly into engineering without approximations. A recap of the required mathematical principles is given. The science of deformation, strain and stress at a point under the application of external traction loads is next presented. Only one-dimensional structures classified as Bars (axial loads), Rods (twisting loads) and Beams (bending loads) are considered in this book. The principal stresses and strains and von Mises stress and strain that used in design of structures are next presented. Lagrangian solution was used to derive the governing differential equations consistent with assumed deformation field and solution for deformations, strains and stresses were obtained. The finite element method most suitable for HPC is derived and the corresponding stiffness matrix for the element is derived. Assembling procedure of these matrices is then described to obtain the system matrices. Worked examples and exercises are given in each chapter. This book brings SBES at entry level allowing young students to quickly adapt to modern design practices.

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