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Computational Mechanics: The Third Scientific Methodology



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ABSTRACT:

Every phenomenon in nature may be described using the laws of physics, resulting in a mathematical model in terms of algebraic, differential, and/or integral equations relating the various physical parameters of interest, e.g. velocities, pressure, stresses. Engineers studying practical problems are faced with the task of solving the mathematical models in order to understand the phenomena and/or predict a response to an externally applied stimuli and ultimately design and manufacture systems for human convenience and comfort. Computational mechanics is an integral and major component in many fields of engineering, design, and manufacturing. Major established industries such as the automobile, aerospace, atmospheric sciences, chemical, pharmaceutical, petroleum, electronics and communications, as well as emerging industries such as biotechnology, and information technology rely on computational mechanics-based capabilities to model and simulate complex systems for the design and manufacturing of high-technology products. In this lecture, the basic idea of the finite element method is reviewed and an overview of the author's research in mathematical modeling and numerical simulations of problems in solid mechanics, fluid mechanics, and biological systems is presented. In particular, author's research in modeling of biological cells, laminated composite plates and shells, and flows of viscous incompressible fluids is presented.

BIOGRAPHY:

Junuthula N. Reddy is a Distinguished Professor, Regents' Professor and inaugural holder of the Oscar S. Wyatt Endowed Chair in Mechanical Engineering at Texas A&M University, College Station, Texas, USA.[1] He is one of the researchers responsible for the development of the Finite Element Method (FEM). He is an authoritative figure in the broad area of mechanics. He has made significant seminal contributions in the specific areas of finite element method, plate theory, solid mechanics, variational methods, mechanics of composites, functionally graded materials, fracture mechanics, plasticity, biomechanics, classical and non-Newtonian fluid mechanics, and applied functional analysis. Reddy has over 480 journal papers, 18 books (with several second and third editions), and has given numerous national and international talks. He has served as a member of International Advisory Committee at ICTACEM, 2001 and keynote addressing in 2014.