Course Objective

The primary objectives of this course are:
(1) To study the conservation and balance principles in mechanics of continua and formulate the equations that describe the motion and mechanical behavior of materials; and
(2) To present the applications of these equations to simple problems associated with flows of fluids, conduction of heat, and deformation of solid bodies.

While the first of these objectives is an important topic, the reason for the formulation of the equations is to gain a quantitative understanding of the behavior of an engineering system. This quantitative understanding is useful in the analysis, design, and manufacture of better products.

The participants of the course must have had a course on differential equations and an undergraduate degree in engineering or equivalent. The course will not discuss any specific industrial applications.

Course Outline

First Day:

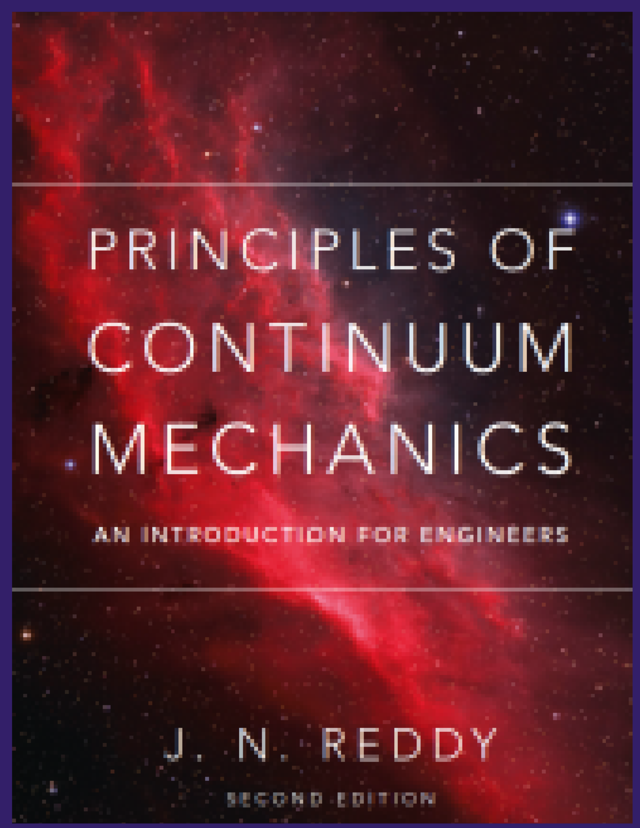
- Introduction to the concept of continuum and vectors and tensors
- Kinematics of a continuum (strain measures)
- Concept of stress vector and tensors
- Descriptions of motion
- Examples and Interaction session (Q&A)

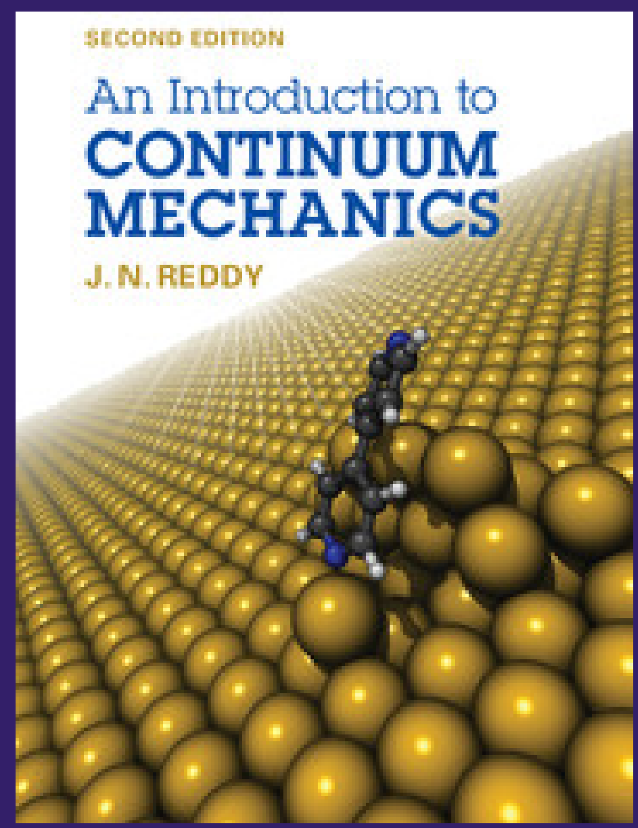
Second Day:

- Conservation of mass principle
- Balance of linear and angular momenta and energy
- Materials constitutive laws
- Compatibility conditions
- Examples and Interaction session (Q&A)

Course Material

The material for the course is from the author's books, Principles of Continuum Mechanics by J. N. Reddy (Cambridge University Press, 2018; Second Edition) and Introduction to Continuum Mechanics by J. N. Reddy (Cambridge University Press, 2013; Second Edition). The books will not be included as the course material. A copy of all slides used in the course will be distributed in the form of a PDF file to the participants prior to the course. The participants are encouraged to read the books for further reference.





Registration Link

https://forms.gle/DRwfQLm4g3Eh9cZ7A

Scan here for Registration

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RAMAIAH UNIVERSITY OF APPLIED SCIENCES

INSTITUTION'S INNOVATION COUNCIL (Ministry of Education Initiative)

SAEINDIA Society of Automotive Engineers INDIA

ASME SETTING THE STANDARD

Two-Day Short Course On

CONTINUUM MECHANICS WITH APPLICATIONS

By

Prof. J. N. Reddy

Texas A&M University, College Station, Texas USA

Jointly Organized By

Department of Automotive and Aeronautical Engineering
and
Department of Mechanical and Manufacturing Engineering

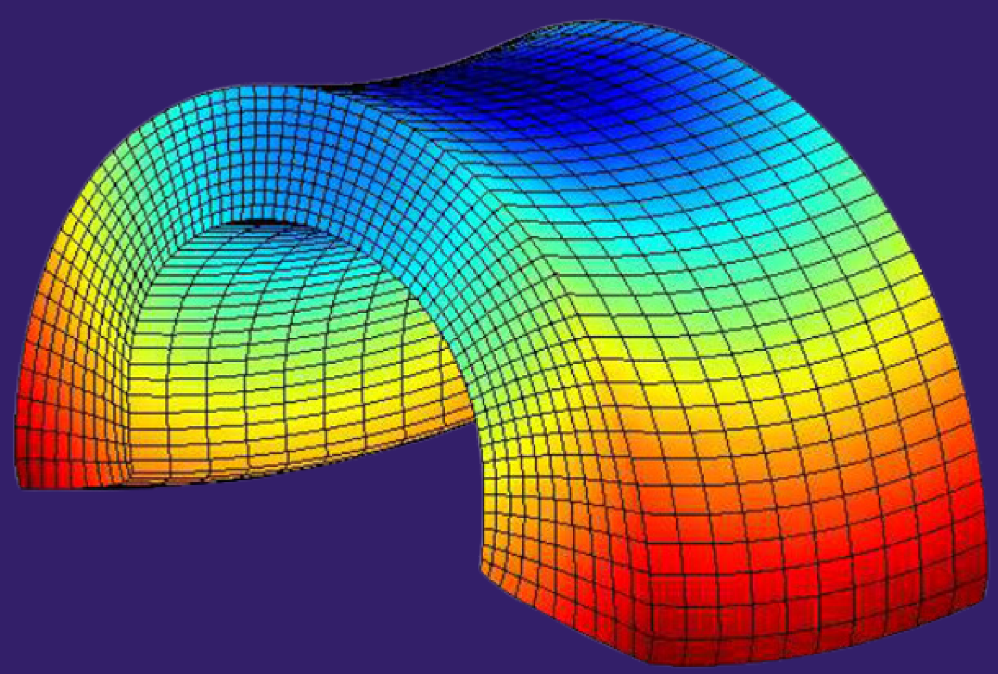
10 - 11 JULY 2024

A206 Seminar Hall, RTC, MSRUAS, Peenya

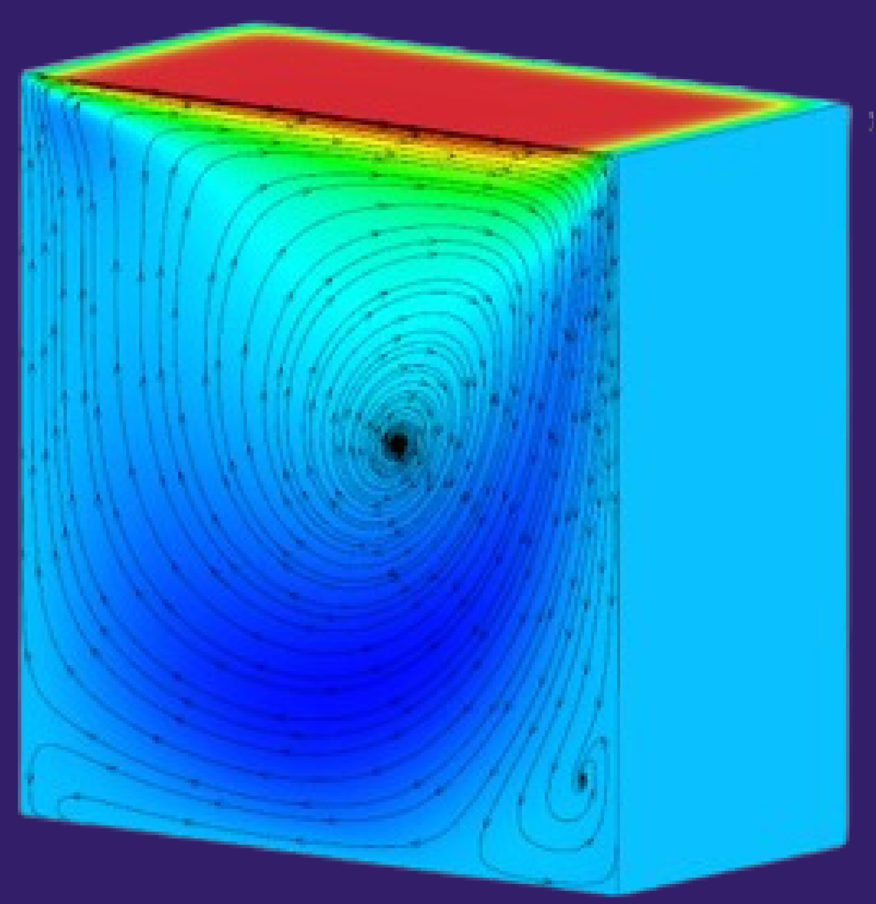
About Prof. J N Reddy

Prof. J N Reddy is a Distinguished Professor, Regents' Professor, and inaugural holder of the O'Donnell Foundation Chair IV Professor in Mechanical Engineering at Texas A&M University, College Station, Texas. Dr. Reddy, an ISI highly-cited researcher, is known for his significant contributions to the field of applied mechanics through the authorship of 25 textbooks and nearly 800 journal papers. His pioneering work on the development of shear deformation theories (that bear his name in the literature as the Reddy third-order plate theory and the Reddy layerwise theory) has had a major impact and have led to new research developments and applications. Some of the ideas on shear deformation theories and penalty finite element models of fluid flows have been implemented into commercial finite element computer programs like ABAQUS, NISA, and HyperXtrude. In recent years, Reddy's research has focused on the development of locking-free shell finite elements and nonlocal and non-classical continuum mechanics problems involving couple stresses and damage and fracture in solids.

Prof. Reddy has received numerous honors and awards. Most recent ones include: 2023 Leonardo da Vinci Award from the European Academy of Sciences, 2022 IACM Congress (Gauss-Newton) Medal from the International Association of Computational Mechanics, the 2019 SP Timoshenko Medal from the American Society of Mechanical Engineers, the 2018 Theodore von Karman Medal from the American Society of Civil Engineers, the 2017 John von Neumann Medal from the U.S. Association of Computational Mechanics, the 2016 Prager Medal from the Society of Engineering Science, and 2016 ASME Medal from American Society of Mechanical Engineers. He is a member of eight national academies, including the US National Academy of Engineering, and a foreign fellow of the Indian National Academy of Engineering, the Canadian Academy of Engineering, the Brazilian National Academy of Engineering, the Chinese Academy of Engineering, the Royal Engineering Academy of Spain, the European Academy of Sciences, and the European Academy of Sciences and Arts. In a recent ranking of best researchers in mechanical and aerospace engineering (https://research.com/u/j-n-reddy), he was ranked 8th in the world and 5th in the USA.



Deformed Thick Beam



Lid-driven Cavity Flow

Background to the Course

The study of matter at molecular or atomistic levels is very useful for understanding a variety of phenomena, but studies at these scales are not useful for solving common engineering problems. The understanding gained at the molecular level needs to be taken to the macroscopic scale (that is, a scale that a human eye can see) to be able to study its behavior. Central to this study is the assumption that the discrete nature of matter can be overlooked, provided the length scales of interest are large compared to the length scales of a discrete molecular structure. Thus, matter at sufficiently large length scales can be treated as a continuum in which all physical quantities of interest, including density, are continuously differentiable.

Engineers and scientists undertake the study of continuous systems to understand their behavior under ``working conditions," so that the systems can be designed to function properly and produced economically. For example, if we were to repair or replace a damaged artery in a human body, we must understand the function of the original artery and the conditions that led to its damage. An artery carries blood from the heart to different parts of the body. Conditions like high blood pressure and an increase in cholesterol content in the blood may lead to the deposition of particles in the arterial wall. With time, the accumulation of these particles in the arterial wall hardens and constricts the passage, leading to cardiovascular diseases. A possible remedy for such diseases is to repair or replace the damaged portion of the artery. This in turn requires an understanding of the deformation and stresses caused in the arterial wall by the flow of blood. The understanding is then used to design the vascular prosthesis (that is, an artificial artery).