

COURSE VENUE

Aalto University, Department of Mechanical Engineering.



FURTHER INFORMATION AND REGISTRATION

The course participants are expected to pre-register to the course due to limited number of places available for the course. For pre-registration, please send email to jani.romanoff@aalto.fi by July 31st 2023.

Aalto University, School of Engineering

P.O. Box 14100 (Otakaari 4)

FI-00076 AALTO

Email: jani.romanoff@aalto.fi

A four-day course on

THEORY AND ANALYSIS OF LAMINATED COMPOSITE AND FUNCTIONALLY GRADED STRUCTURES

5-8th September 2023

by **J. N. Reddy**

Texas A&M University, College Station, Texas USA

The present course is primarily intended for structural engineers from aerospace, civil, and mechanical/marine engineering industries as well as graduate students and faculty from academia. The course has 3+2 credit points with first 3 cp from participation to lectures and computational tasks to be delivered after the course and remaining 2 cp for those writing a reflective learning diary about the theory, practice and applications to be delivered also after the course.

COURSE OBJECTIVES

The course is aimed at providing participants with the theory and analysis (and some design considerations) in dealing with composite structural components in the form of beams, plates, and shells laminated of fiber-reinforced materials and two-constituent functionally graded beams and plates. Theoretical formulations and applications will be presented to illustrate the concepts.

The participants of the course must have a background in mechanics of materials and structures and a course on differential equations (i.e., at least an undergraduate degree in engineering is required). The course will not discuss any specific industrial applications.

BACKGROUND

The increased use of composite and functionally graded materials in a variety of engineering structures (e.g., aerospace, automotive, off-shore, and marine and underwater structures, as well as in medical prosthetics and sports equipment) and the number of journals and conferences held in the last five decades attest to the fact that there has been a major effort to develop modern composite and functionally graded material systems for a variety of applications, and analyze and design structural components made from composite materials. The subject of composite materials is truly an interdisciplinary area where chemists, material

ABOUT DR. REDDY



Dr. Reddy is a Distinguished Professor, Regents' Professor, and inaugural holder of the *O'Donnell Foundation Chair IV* 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 works 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*) have 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.

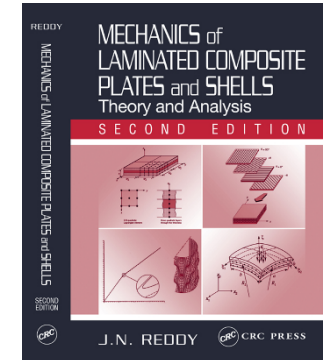
Dr. Reddy has received numerous honors and awards. Most recent ones include: 2022 *IACM Congress (Gauss-Newton) Medal*, 2019 *SP Timoshenko Medal* from American Society of Mechanical Engineers, 2018 *Theodore von Karman Medal* from the American Society of Civil Engineers, the 2017 *John von Neumann Medal* 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 US National Academy of Engineering and foreign fellow of the Brazilian National Academy of Engineering, Indian National Academy of Engineering, the Canadian 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. A more complete resume with links to journal papers can be found at <http://mechanics.tamu.edu>.

scientists, chemical engineers, mechanical engineers, and structural engineers contribute to the overall product.

COURSE OUTLINE

Tuesday September 5th, 2023, 09:00-15:00:
Otakaari 1, U358

- Composite Materials: An Introduction
- Anisotropic Elasticity and Functionally Graded Materials
- Structural Theories of Composite Laminates: Classical laminate plate theory (CLPT)
- Structural Theories of Composite Laminates: First-order shear deformation theory (FSDT)
- Interaction session (Q&A)



Wednesday September 6th, 2023, 09:00-15:00:
9-12: Otakaari 1, U119 DELOITTE ; 12-15: Otakaari 1, U358

- Analytical Solution Methods: Navier solution procedure
- Numerical examples of bending, vibration, and buckling solutions of laminated plates
- Finite Element Models of Composite Laminates: Theoretical developments
- Numerical Results and Discussion
- Interaction session (Q&A)

Thursday September 7th, 2023, 09:00-15:00:
9-12: Otakaari 1, U147 U5 ; 12-15: Otakaari 1, U154 U1

- Functionally Graded Materials: Beams
- Functionally Graded Materials: Plates
- Finite element models of FGM Beams and Plates
- Numerical Results and Discussion
- Interaction session (Q&A)

Friday September 8th, 2023, 09:00-15:00:
9-15: A Grid / Otakaari 5, A108b / A111a Mordor

- Finite Element Models of Laminated Shell Structures
- Numerical Examples and Discussion
- Failures in composites and Design Considerations
- Overview of the course
- Interaction session (Q&A)