A Four-Day* Short Course on The Finite Element Method (with applications to heat transfer, fluid mechanics, solid mechanics and biomechanics)

12th -15th December 2012
*with commercial vendors’ participation to demonstrate their software

Course Faculty
Dr. J. N. Reddy
Department of Mechanical Engineering
Texas A&M University
College Station, Texas 77843-3123 USA
e-mail: jnreddy@tamu.edu

Convener
Dr. D. Kingsly Jeba Singh
(E-mail: dean.mech@ktr.srmuniv.ac.in)

Coordinator
Mr. KR. Arun Prasad
(E-mail: arunprasad.kr@ktr.srmuniv.ac.in)
Short Term Course on “Introduction to FEM”

About The University

SRM University is one of the top ranking universities in India with over 20,000 students and 1,500 faculties, offering a wide range of undergraduate, postgraduate, and doctoral programs in Engineering, Management, Medicine and Health sciences, and Science and Humanities. This University with institutions of 27 years of existence under its ambit has emerged as one of the largest privately funded Universities. Over two and half decades, SRM University has set standards in experimental education and knowledge creation across various fields. Over 600 acres replete with a variety of facilities, State-of-the-art labs, libraries, Wi-Fi, Knowledge center, 4500 capacity AC auditorium, 100 online smart classrooms, Hostels with premium facilities. SRM University is the first private university in India to launch the nano satellite named, SRMSAT; it has been designed by students and faculties of SRM University. The design is made robust enough to support different payloads and act as a Nano Bus for further missions. By this process SRM University would be able to provide qualified and trained scientific and technological manpower in satellite technology. Added to the crowning glory for the SRM University is that the 98th Indian Science Congress was hosted with the theme ‘Quality Education and Excellence in Scientific Research in Indian Universities’, was formally inaugurated by Prime minister Dr. Manmohan Singh in which more than10,400 delegates from India and abroad including six Nobel Laureates has participated.

Finite Element Method...

The Finite Element Method (FEM) is a numerical and computer-based technique of solving a variety of practical engineering problems that arise in different fields. It is recognized by developers and users as one of the most powerful numerical analysis tools ever devised to analyze complex problems of engineering. The underlying theory of the method is now well established, with many books and courses providing adequate explanations of the theory. However, most people using the method, via commercial software or in-house codes, do not often understand the method as applied to engineering problems, especially in generating input data and interpreting the results.

Course Objectives

The major problem facing the engineering analyst contemplating the use of the technique lies in acquiring appropriate knowledge to provide assurance that the finite element model produced gives a reasonably reliable representation of the “real life” problems being
analyzed. The present course is designed to bridge the gap between the theoretical finite element knowledge and its industrial applications by providing sufficient insights into the relationship between the physical data (e.g., loads, boundary conditions, constitutive behavior, etc) and the finite element model.

The lecturer will share practical applications and their experiences to address some of the issues such as element selection, mesh design, convergence, and response characteristics.

This course is intended to provide graduate students, engineers, and researchers working in aerospace, automotive, civil, mechanical engineering, and information technology industries as well as numerical analysts and materials scientists with the theory and applications of linear finite element analysis of problems from heat transfer, fluid mechanics, and solid and structural mechanics.

Course Faculty

J. N. REDDY
Distinguished Professor
Department of Mechanical Engineering
Texas A&M University

Dr. Reddy is a Distinguished Professor and inaugural holder of the Oscar S. Wyatt Endowed Chair in Mechanical Engineering at Texas A&M University, College Station, Texas. Dr. Reddy is the author of over 450 journal papers and 17 text books on theoretical formulations and finite-element analysis of problems in solid and structural mechanics (plates and shells), composite materials, computational fluid dynamics, numerical heat transfer, and applied mathematics. Professor Reddy is internationally-known for his research on mechanics of composite materials and for computational methods. The shear deformation plate and shell theories that he developed and bear his name in the literature are well known, and finite element models he developed have been implemented into commercial software like ABAQUS, NISA, and HYPERFORM. Such an eminent record of research has earned Dr. Reddy numerous national and international awards, including the Charles Russ Richards Memorial Award and the Worcester Reed Warner Medal of the American Society of Mechanical Engineers, Nathan M. Newmark Medal
from the American Society of Civil Engineers; Award for Excellence in the Field of Composites, Distinguished Research Award from the American Society for Composites, the Computational Solid Mechanics award from US Association for Computational Mechanics, and the Archie Higdon Distinguished Educator Award from the American Society of Engineering Education. Recently, Dr. Reddy presented the prestigious “The 2009 Landis-Epic Lecture” at the University of Pittsburgh, and received Honoris Causa, Honorary degree, from the Technical University of Lisbon, Portugal; and Honorary Doctoral degree from Odlar Yurdu University, Baku, Azerbaijan, in 2011. In addition, Dr. Reddy is one of the very few researchers in engineering around the world, who is recognized by ISI Highly Cited Researchers (with over 10,000 citations and h-index of 50). Professor Reddy has had profound influence on the careers of many students and young researchers who came in contact with him during his professional career (not only as students and collaborators but also as participants in his short courses, workshops and seminars during his visits to various institutions and conferences). Some never met him but were influenced by his writings.

**Profile Of Participants**

The course is aimed at students, analysts, and researchers who are involved with the analysis of differential equations arising in engineering and applied science, and who are using or plan on using commercially available finite element packages to analyze problems in the aeronautical, automobile, mechanical, civil and other engineering industries. The course will also enable participants to be able to write their own FEM software. Participants are assumed to have knowledge of the basic principles of engineering (i.e., undergraduate degree in engineering). Some knowledge of the finite element method is an advantage, but not essential.

**Benefits of Attending the Course**

Persons who have attended the course and followed the material should benefit in strengthening their background in the following areas:

- A strong understanding of the formulative steps involved in the finite element model development of the equations of engineering and applied science, including certain heat transfer and fluid flow problems.
- Generation of finite element data (e.g., selection of elements and mesh, computation of nodal forces), imposition of...
boundary conditions, post-computation of stresses and strains, etc.), exploitation of problem symmetries, and interpretation and evaluation of the results.

Course Material And Reference Book

Course Contents

• Background: Introduction to numerical methods
  o Overview – basic ingredients of the FEM
  o Comparison with alternative solution methodologies
• The basic concepts in FEM – one-dimensional problems
  o Axial deformations of a bar and 1-D heat transfer
  o Strong and weak forms
  o Essential vs. natural boundary conditions
  o Integral statements (Principle of the minimum potential energy)
  o Methods of approximations (Ritz & Galerkin methods)
  o Finite element approximation functions (linear, quadratic, and cubic elements)
  o Assembly of element equations
  o Illustrative examples and discussion of results in light of physical response
  o Flexure of beams (Euler-Bernoulli and Timoshenko) beams
• Generalization of the basic concepts to two dimensions
  o Membrane and heat transfer-like problems in 2D
  o Elements types (triangular and quadrilateral elements)
  o Subparametric, isoparametric, and superparametric formulations
  o Transient Analysis
• Eigenvalue and time-dependent problems
  o Free vibration of elastic systems (natural frequencies, modal response, etc)
  o Transient analysis for parabolic and hyperbolic equations
• Numerical/computational issues
  o General modeling considerations
  o Numerical integration
• Elasticity problems
  o Governing equations of plane elasticity problems
  o Elements types (triangular and quadrilateral elements)
  o Examples
• Three-dimensional problems
  o Axisymmetric problems
  o Heat transfer problems
  o Elasticity problems
  o Types of 3-D finite elements (interpolation functions)
• Plate bending problems
  o Governing equations of classical and shear deformation theories
  o Finite element models
  o Examples
• Modeling of Biological Cells and Soft Tissue Mechanics
  o General modeling considerations
  o Numerical Examples
• Introduction to viscous flow problems
  o Governing equations (Navier-Stokes Equations)
  o Mixed finite element model (2D)
  o Penalty finite element model (2D)
  o Numerical examples

Application
Please fill out the Registration / application form and send it before the date indicated along with DD in favour of “FEM Course 2012” payable at Chennai.

Workshop fee:
• Rs.10000/- for participants from industry and research laboratories
• Rs.6000/- for faculty
• Rs.4000/- for research scholars
The workshop fee includes: Lunch, and snacks; CD and other course materials. On campus accommodation available for nominal fee.

Selection Procedure
Maximum number of participants limited to 35 for this short term course. Selection is based on First come first served basis.

Intimation of selection:
(Through Email only)

Mailing Address
Prof. D. Kingsly Jeba Singh,
Convener- Short term Course on FEM,
Dean i/c, School of Mechanical Engineering,
SRM University, Chennai- 603203.
Telephone: +91-44-27452270 Extn. 1801
Mobile: +91-9444925837,
Fax No.: +91-44-27452343
E-mail:dean.mech@ktr.srmuniv.ac.in
Website (for additional information):
www.srmuniv.ac.in/FEM course 2012
SRM UNIVERSITY  
CHENNAI – 603203, India.  
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REGISTRATION FORM  
(Please mail to reach before 30 Nov 2012)  

Name:_____________________________________
Academic Qualification:_______________________
Designation:________________________________
Organization:________________________________
Mailing Address:________________________________
Telephone:_________________________________
Fax:_______________________________________
Email:_____________________________________

I agree to abide by the rules of the course. If selected, I shall participate in the course for the entire duration.

Registration Fee Details:

Amount .............................................................
DD No.: ............... Bank Name: ..............................
Accommodation Requirement:  YES  /  NO

Date:  
Signature