

Nonlinear Fracture Mechanics and Applications to Structural Integrity Assessment

Overview

The goal of the course is to provide an in-depth treatment of advanced topics in Fracture Mechanics such as fracture and crack growth under elastic-plastic and time-dependent creep and creep-fatigue conditions. The course emphasizes fundamental underpinnings of nonlinear fracture mechanics and its use in material evaluation and life prediction methodology for structural components. Micro-mechanics of fracture and crack growth processes are also covered. Upon completion of this course, the students will be ready to undertake research in areas of nonlinear fracture mechanics and/or apply the concepts to evaluate integrity of structural components including assessing safety margins of new designs, predicting remaining life of components in service, or developing a rational criterion for choosing appropriate inspection techniques. Examples used will be from jet engines, power-generation equipment, pressure vessels for hydrogen storage, and oil and gas industries.

The course will address topics such as Analysis of Cracks under Elastic-Plastic Loading, J- Integral as Fracture Criterion, Methods of Determining J, Crack Growth Resistance Curves, Micromechanics of Ductile Fracture and Constraint Effects, Fatigue Crack Growth under Gross Plasticity, Analysis of Cracks in Creeping Bodies, Creep Crack Growth, Creep-fatigue Crack Growth, and Applications of Nonlinear Fracture Mechanics in integrity assessment of components operating at high temperatures.

The course assumes that students are already familiar with linear elastic fracture mechanics, the stress intensity parameter and how it applies to predicting crack growth and fracture under dominantly linear elastic conditions, and with the limitations of linear fracture mechanics. The course will consist of 11 lectures of about one- hour duration and five hours of hands-on problem- solving sessions with students participating in group exercises. There will be also be three, 30-minute examinations for evaluating student performance.

Dates for the Course	11 December, 2017 to 16 December, 2017
Host Institute	IIT Madras
No. of Credits	1
Maximum No. of Participants	30
You Should Attend If you are	<ul style="list-style-type: none"> ▪ An engineering post-graduate student in Materials Science, Mechanical, Civil, or Aerospace Engineering working in the field mechanical testing and fracture. ▪ R&D scientist, or a faculty member in an academic institution interested in fracture ▪ Working in aircraft, power generation, oil and gas industry designing and maintaining load-bearing equipment.
Course Registration Fees	<p>The participation fees for taking the course is as follows: Student Participants: Rs. 2000 Faculty Participants: Rs 5000 Government Research Organization Participants: Rs. 10000 Industry Participants: Rs.15000</p> <p>The above fee is towards participation in the course, the course material, computer use for tutorials and assignments, and laboratory equipment usage charges. Mode of payment: Demand draft in favor of "Registrar, IIT Madras" payable at Chennai. The demand draft is to be sent to the Course Coordinator at the address given below.</p>
Accommodation	<p>The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel/</p>

Course Faculty



Dr. Ashok Saxena is a Distinguished Professor and Dean Emeritus in the Department of Mechanical Engineering at the University of Arkansas. His research interests for the past 40 years have included fracture and crack growth behavior of structural materials with emphasis on development of nonlinear fracture mechanics concepts and test methods for predicting creep and creep-fatigue crack growth. He has worked in academia, research laboratories, and industry, and has published several textbooks, research monographs, and over 200 journal and conference papers on the subject. Dr. Saxena has received several national and international awards for his pioneering research contributions in fracture mechanics that include the Wohler Fatigue Medal from ESIS, Irwin Medal from ASTM, Fracture Mechanics Medal from ASTM, and Paris Gold Medal from ICF. At the University of Arkansas, Dr. Saxena served as the Provost and Vice Chancellor of Academic Affairs for the University, Dean of Engineering, and the Irma and Raymond Giffels' Chair. He previously served as Regents' Professor and Chair of the School of Materials Science and Engineering at Georgia Institute of Technology in Atlanta where he received the Outstanding Researcher Award, and as Fellow Scientist at the Westinghouse R&D Center in Pittsburgh, PA.



Dr. Raghu Prakash is a Professor at the Department of Mechanical Engineering, Indian Institute of Technology Madras; he specializes in the areas of fatigue, fracture of materials (metals, composites, hybrids), structural integrity assessment, remaining life prediction of critical components used in Transportation, Energy sectors, apart from new product design. He has more than twenty five years of professional experience in the field of fatigue and fracture and has to his credit more than 100 Journal, Book Chapter publications and 100 Conference publications and has edited 3 book volumes. He began his career as Scientist at National Aerospace Laboratories, Bangalore and has developed test systems for use in academia, R&D and industry during his tenure as Technical Director at BiSS Research, Bangalore; he teaches courses relating to Fracture Mechanics, Design with Advanced Materials, Product Design, DFMA at IIT Madras. He is a voting rights member of ASTM International (Technical Committees, D-30, E-08 and E-28) and has won several prestigious awards (Binani Gold Medal, Indian Institute of Metals), scholarships and Erasmus-Mundus Fellowships. He is the recipient of Distinguished Fellow of ICCES 2015 and Editor-in-Chief of Journal of Structural Longevity. He is a member of several technical societies (Indian Structural Integrity Society, Society for Failure Analysis, Indian Institute of Metals to name a few).

Course Coordinator

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