Unique Course Series by Professor Pingsha Dong

1st Time in India

Professor, Naval Architecture and Marine Engineering
Professor, Mechanical Engineering
Director, Welded Structures Laboratory
University of Michigan, Ann Arbor, MI

Course I
Weld Residual Stresses, Distortions, and Fitness for Service

Course II
Mesh-Insensitive Fatigue Evaluation Method for Welded Structures

Date: Course I: 19 & 20th June 2017
Course II: 21 & 22nd June 2017

Venue: Hotel Goldfinch
Bangalore, India

Email: info@dhioresearch.com
Phone: +91 9591994642
+91 9900138009
Professor Pingsha Dong teaching and research interests include advanced design and analysis methodologies for engineering structures with an emphasis on welded structures and novel computational modeling techniques for manufacturing processes. He has developed numerous unique computational procedures that have been adopted by major manufacturing industries and National/International Codes & Standards. These include the mesh-insensitive structural stress method for fatigue design and life evaluation of welded structures adopted by 2007 ASME Div 2 International Code, the Joint 2007 ASME FFS-1/API 579 RP-1 Fitness for Service Code. Dr. Dong has published about 200 papers in peer-reviewed archive journals and major conference proceedings, giving over two dozens of Plenary/Keynote Lectures at major international conferences.

RESEARCH

Dr. Dong’s current research activities are focused upon the following topical areas:

- Math-based design-for-producibility evaluation methods for lightweight metallic structures
- Shear localization modeling of friction stir weld formation and process window estimation techniques, particularly for dissimilar material joining
- Robust modeling techniques for welding-residual stresses and distortions, and effective mitigation techniques
- Mesh-insensitive method for fatigue and fracture evaluation of welded structures
- ECA procedures for FPSOs (Floating Production, Storage and Offloading units) and mooring systems
- Advanced Fitness-for-Service (FFS) or Engineering Critical Assessment (ECA) methods, particularly on fracture mechanics treatment of residual stresses
- Fatigue damage modeling methods for non-proportional multiaxial loading
- Advanced fatigue design and life evaluation methods for high-speed train vehicles and equipment

HONORS, AWARDS, AND RECOGNITIONS

Representative National & International Awards:

- AWS 2015 Fellow Award
- IIW (International Institute of Welding) 2014 Fellow Award
- SNAME’s Elmer L. Hann Award (2012)
- IIW (International Institute of Welding) 2008 E. Paton Prize
- SNAME’s Elmer L. Hann Award (2007)
- R&D Magazine's 2006 R&D 100 Award for Verity™ development
- TIME Magazine’s Math Innovator (2005)
- Aviation Week & Space Technology Magazine’s Aerospace Laurels 2004 Award
- AWS 2004 R. D. Thomas Memorial Award
- SAE 2003 Henry Ford II Distinguished Award for Excellence in Automotive Engineering
- ASME 2003 G.E.O Widera Literature Award
- AWS 1998 Rene Wasserman Best Paper Award

EDITORSHIP FOR ARCHIVE JOURNALS

- Associate Editor, International Journal of Pressure Vessel and Piping (2015-Present)
- Editorial Board Member, International Journal of Naval Architecture and Ocean Engineering (2014-present)
- Editorial Board Member, Int. J. of Science and Technology of Welding and Joining (2002-2010)

Courses Developed and Taught

- Residual Stresses and Distortions in Modern Manufacturing
- Fatigue of Structures
- Defect Assessment
- Finite Element Procedures for Marine Structures
- Ship Production
- Ship Strength Analysis

Keynote Lectures and Publications

Dr. Dong has published over 180 papers in peer-reviewed archive journals and major conference proceedings and provided over a dozen Keynote Lectures at major international conferences.

Detailed Profile

Please Visit: http://www.engin.umich.edu/college/about/people/profiles/a-to-e/pingsha-dong

Write to Prof. Pingsha Dong

Email: dongp@umich.edu
Course I

Weld Residual Stresses, Distortions, and Fitness for Service

About the Course

It is well known that welding-induced residual stresses & distortions can have significant impact on the manufacturability and structural integrity of welded components. This unique course is designed to:

- provide a critical assessment of “state of art” residual stress modeling, analysis, and measurement techniques
- demonstrate effective modeling and analysis procedures for various industrial applications
- guide course participants to define and solve day to day residual stress and distortion control problems, as well as deal with fitness-for-service related needs

Course Content

**Day 1**

- **Importance of understanding residual stresses**
  - Weldability
  - Structural manufacturability
  - Structural integrity

- **Residual stress development mechanisms**
  - 1D thermo-plasticity descriptions
  - Graphic solution technique
  - 3-bar and n-bar models and implications
  - Basic shrinkage modes and distortion types

- **Finite element modeling requirements**
  - Time and length scale considerations
  - Proven residual stress analysis procedures
  - Proven distortion analysis procedures

- **Residual stresses in weld repairs**

- **Comments on residual stress measurements**
  - Why measurements can be wrong!
  - How to interpret measurement results?
  - How to plan measurements plan?

- **Residual stress and distortion mitigation**
  - In-process techniques and examples
  - Post-process techniques and examples

**Day 2**

- **Treatment of residual stress effects on fatigue**
  - S-N curve based method
  - Crack growth method

- **Treatment of residual stresses in FFS**
  - Residual stress decomposition technique
  - Residual stress profile estimation
  - Use of BS 7910 and API 579

- **Real world case studies**
  - Distortion control for a complex plate structure
  - Repair residual stress control and FFS for pipe and vessel components
  - Buckling distortion control in a lightweight stiffened panel
  - Distortion control in lightweight tubular chassis frame FFS

- **Summary and Q/A**
Course II

Mesh-Insensitive Fatigue Evaluation Method for Welded Structures

About the Course

This special course will provide a unique opportunity for attendees to learn the basic principles of structural fatigue design and valuation procedures as well as recent developments in finite element based fatigue life prediction methodologies, with a special emphasis on welded structures. Effective fatigue testing procedures for lab-scale specimens and large scale components will also be discussed, including methodologies for test data interpretation and correlation with computer model predictions.

Course Content

### Day 1

**Fundamental aspects of structural fatigue**

- Initiation versus propagation and failure criteria
- Unique fatigue issues associated with welded joints

**Conventional fatigue evaluation procedures**

- Key assumptions
- Stress definitions and calculation procedures
- Code-recommended S-N curves and assumptions
- Why they don’t work well for structural applications?

**Traction structural stress method – I**

- The traction structural stress definition
- Numerical implementation
- Simple calculation procedures
- Measurement techniques and validations
- Comparison with other stress definitions

### Day 2

**Traction structural stress method – II**

- Generalized calculation stress method
- Mesh-insensitivity validations
- Multi-axial stress state
- Weld root cracking versus weld toe cracking
- Worked examples

**The master S-N curve approach**

- Fracture mechanics consideration
- Master S-N curve formulation and validation
- Load- versus displacement-controlled

**Finite element based structural life prediction procedure**

- Real-world examples
- Plug, resistance spot, laser, and FSW welds
- Treatment of low cycle fatigue
- Treatment of multiaxial fatigue

Summary and Q/A
Registration Form

Course I: Weld Residual Stresses, Distortions, and Fitness for Service
Course II: Mesh-Insensitive Fatigue Evaluation Method for Welded Structures

Name: _______________________________ Street Address/P.O. Box: _______________________
Title: _______________________________ City: __________________ State: _____________
Company Name: ______________________ Zip/Postal Code: ______ Country: ___________
Designation: _________________________ Office Phone: _____________________________
Department: __________________________ Office Fax: ______________________________
E-mail address: ______________________ Mobile: ________________________________

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<th>Course Selection</th>
<th>Course Description</th>
<th>Registration Before 15th May 2017</th>
<th>Registration After 15th May 2017</th>
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<td>COURSE I</td>
<td>Weld Residual Stresses, Distortions, and Fitness for Service</td>
<td>USD 800</td>
<td>USD 950</td>
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Registration fee for Research Scholars/Students please write to info@dhioresearch.com

Registration fee to be paid in the form of DD/Cheque/OnlineTransfer in the name of " DHIO Research and Engineering Pvt Ltd.," Payable at Bangalore.

Registration fee includes course delivery, course material, working tea an lunch

Course Co-ordinators

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