

Residual Stresses and Distortions: Mechanisms, Impact on Structural Integrity, and Mitigation Techniques

eCourse
NOW AVAILABLE



With the advent of greater demand for online training, HERA, IIW India, SAIW and the CWB Association are cooperating and collaborating to transfer the knowledge and experience of world experts into as many countries on a global basis.

The four organizations have arranged for eCourses to be presented by such world experts to meet the challenges of different time zones, the need to assist individuals and industries to optimize their training times as well as improve their national welding capabilities.

You can make inquiries and bookings with each organization offering the course most suitable for

your needs. Links for registration are given later in this brochure.

This is the second eCourse to be offered in a series of three by world expert, Professor Pingsha Dong, University of Michigan, USA.

The understanding and techniques offered by this course can lead to significant savings in mitigating the detrimental effects of residual stresses and distortions in practice

Contacts at each organization for more detailed discussion on all future eCourses to be organized are:

Michail Karpenko • HERA • Email: mkarpenko@hera.org.nz • Asia and Australasia

Max Ceron • CWB Association • Email: Max.Ceron@cwbgroup.org • Americas

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Residual Stresses and Distortions: Mechanisms, Impact on Structural Integrity, and Mitigation Techniques

PRESENTER: PROFESSOR PINGSHA DONG
University of Michigan, Ann Arbor, Michigan, USA

This eCourse will present how residual stresses and distortions are developed during fusion and solid-state welding, and related manufacturing processes, including metal 3D printing and additive manufacturing (AM). Simple analytical models will first be used to describe the underlying mechanisms, and computational modeling results will then be used to demonstrate the relevance of these analytical results for deriving effective solutions to various residual stress and distortion problems experienced by various industry sectors, including aerospace, automotive, heavy equipment, and shipbuilding.

Then, the principles for residual stress and distortion mitigation techniques will be discussed and illustrated with various real-world applications. In addition, how residual stresses and distortions affect components' structural performance (e.g., fatigue capacity) will be discussed, including how to effectively treat their effects in structural integrity evaluation, based on the most recent research findings.

Prof. Pingsha Dong of University of Michigan, is the inventor of the mesh-insensitive structural stress method (also referred to as the Master S-N Curve Method) adopted by the 2007 ASME Div 2 and API 579/ASME FFS-1 Codes and Standards mandated by over 50 countries worldwide. Over the past 10 years, Prof. Dong has taught courses in fatigue design, fracture control, residual stress/distortion control in over a dozen countries around the globe. Prof. Dong has published more than 260 peer-reviewed papers in archive journals and major conference proceedings, including over 20 plenary/keynote lectures at major international conferences. He has received numerous prestigious national and international awards/recognitions, including AWS Comfort Adams Lecture Award (2019), SNAME Helmer L. Hann Awards (both in 2012 and 2007), IIW Evgeny Paton Prize (2008), R&D Magazine's R&D 100 Award (2006), TIME Magazine's Math Innovator (2005), Aviation Week and Space Technology's Aerospace Laurels Award (2004), SAE Henry Ford Award (2003), AWS R.D. Thomas Award, and ASME G.E.O Widera Literature Award (2002), among many others. In addition, he is also a Fellow of ASME, AWS, and IIW.



Who Should Attend?

Designers, structural engineers, consultant engineers, mechanical engineers, welding and production engineers, maintenance and quality control engineers, as well as researchers. Delegates are encouraged to bring along their design problems to contribute to discussions and local case studies.

What Industry Areas The eCourse Is Relevant For?

The eCourse will be especially relevant to all professionals in automotive, aerospace, steel construction, steel bridge design, power generation, naval and shipbuilding, offshore construction, pipeline and other industries that apply welding.

eCourse Programme

This live eCourse will include 2 x 4 hour sessions including Q&A. The eCourse will be hosted via MS Teams/Zoom, with login details supplied upon registration.

Part 1: Residual stress and distortion development mechanisms (4 hours)

- Some well-documented residual stress and distortion examples and new challenges
- Residual stress development mechanisms - A:
 - Basic thermo-mechanical descriptions
 - 1-bar model and graphic solution method
 - Engineering implications
- (15 minute break)**
- Residual stress development mechanisms - B:
 - 3-bar models
 - n-bar models
 - Treatment of moving heat source and experimental validations
- Distortion mechanisms
 - Plastic zone versus shrinkage zone
 - Determination by experimental and numerical methods
 - Shrinkage modes versus distortion types observed in practice

Part 2: Principles of mitigation techniques, applications and structural integrity (4 hours)

- Principles of distortion control technique and mechanics basis
 - Shrinkage zone based – single-weld components
 - “5S” principles – multiple welded components
 - Application examples
- (15 minute break)**
- Effects of residual stresses on structural performance
 - Static load capacity and fracture control
 - Fatigue capacity
- Residual stresses in weld repairs and mitigation techniques
 - Intrinsic repair weld residual stress characteristics
 - Mitigation by repair weld design and other methods
- Course summary and Q/A

Earn PDHs and CEUs with our Professional Development eCourse

Upon completion of the 2 eCourse modules, the attendees will receive an electronic Course Completion Certificate that might be used to claim PDHs or CEUs.

EVENTS FOR AMERICAS

Course part	Course Date	Location / time zone / starting time
1	29 March 2022	Toronto/Michigan (EST): 9:00 am - 1:15 pm Calgary & Edmonton (MST): 7:00am - 11:15 am Regina (CST): 7:00am - 11:15 am West Coast Canada and USA (PST): 6:00 am - 10:15 am Atlantic Canada and USA: 10:00 am - 2:15 pm Sao Paulo: 10:00 am - 2:15 pm Brazil: Santiago Chile (GMT): 10:00 am - 2:15 pm
2	31 March 2022	

• **Registration link:** <https://www.eventbrite.ca/e/residual-stresses-and-distortions-session-2-of-3-tickets-253267298307>

CLICK HERE TO REGISTER

EVENTS FOR AFRICA AND EUROPE

Course part	Course Date	Location / time zone / starting time
1	29 March 2022	Johannesburg-CET: 3:00 pm - 7:15 pm Nigeria-London: 2:00 pm - 6:15 pm Istanbul: 4:00 pm - 8:15 pm India & Sri Lanka: 6:30 pm - 10:45 pm Bangladesh: 7:00 pm - 11:15 pm Saudi Arabia, Oman, Kuwait, Bahrain: 4:00 pm - 8:15 pm UAE- Dubai, Sharjah, Abu Dhabi: 5:00 pm - 9:15 pm
2	31 March 2022	

• **Registration link:** <https://www.eventbrite.ca/e/residual-stresses-and-distortions-session-2-of-3-tickets-253267298307>

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EVENTS FOR ASIA AND AUSTRALASIA

Course part	Course Date	Location / time zone / starting time
1	3 May 2022	Auckland: 2:00 pm - 6:15 pm Sydney: 12:00 pm - 4:15 pm Perth: 10:00 am - 2:15 pm Singapore: 10:00 am - 2:15 pm Bangkok: 9:00 am - 1:15 pm Seoul: 11:00 am - 3:15 pm Tokyo: 11:00 am - 3:15 pm
2	5 May 2022	

• **Registration link:** www.hera.org.nz/events/

CLICK HERE TO REGISTER

EVENTS FOR SAARC AND MIDDLE EAST

Course part	Course Date	Location / time zone / starting time
1	3 May 2022	India & Sri Lanka: 8:00 am - 12:15 pm Bangladesh: 8:30 am - 12:45 am
2	5 May 2022	Saudi Arabia, Oman, Kuwait, Bahrain: 5:30 am - 9:45 am UAE-Dubai, Sharjah, Abu Dhabi: 6:30 am - 10:45 am

● **Registration link:** www.hera.org.nz/events/

CLICK HERE TO REGISTER

Cost

The course registration fee per participant is **\$500.00 payable in US dollars** or the equivalent amount in the regional organizer’s local currency.

Participants will receive a set of notes for each course part in pdf format.

REGISTER TODAY

To register, follow the registration links for regions below:

- **Asia and Australasia:** www.hera.org.nz/events/
- **Americas:** <https://www.eventbrite.ca/e/residual-stresses-and-distortions-session-2-of-3-tickets-253267298307>
- **Africa and Europe:** <https://www.eventbrite.ca/e/residual-stresses-and-distortions-session-2-of-3-tickets-253267298307>
- **SAARC and Middle East:** www.hera.org.nz/events/

Cancellations

Please Note: cancellations within seven (7) working days of the start of the events, 100% of the fees will be charged. Replacement delegates may be sent however in lieu of those cancelled. The organizers reserve the right to cancel the courses due to insufficient registrations or other reasons beyond their control, as well as altering the program if they deem it necessary. The organizers have the right to refuse registrations.

Future WIN eCourses to be held in 2022 with Prof Pingsha Dong;

“Advanced Fatigue And Fracture Analysis Methods”

Dates to be advised after May 2022

Upon completion of 2 eCourse modules, the attendees will receive an electronic Course Completion Certificate that might be used to claim PDHs or CEUs.