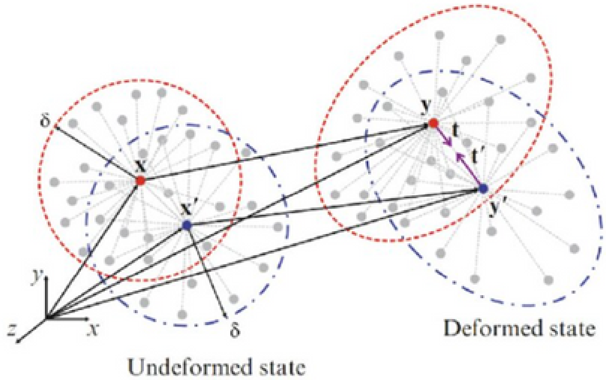
INTRODUCTION TO PERIDYNAMICS

Overview and General Information:
The nonlocal peridynamic theory provides the capability for improved modeling of progressive failure in materials and structures. This course starts with an overview of the Peridynamic (PD) theory and derivation of its governing equations based on the balance laws of classical continuum mechanics. Subsequently, it presents derivation of the PD differential operator (PDDO) which enables the PD form of the governing equations of classical continuum mechanics. This course presents not only the theoretical basis but also its numerical implementation for the solution of governing field equations.



Learning Objectives:
The primary objective of the course is to acquaint students with the concept of PD, and derivation of the bond-based and state-based PD equilibrium equations through the Euler-Lagrange equations. Also, it acquaints the students with the derivation of PD differential operator, and its use in the construction of governing equations for elastic and elastic-plastic material response as well as the coupling of PD with the finite element analysis.

COURSE OUTLINE

Review of Continuum Mechanics: Postulations, Kinematics, Cauchy's hypothesis, Stress tensor, Balance laws in Mechanics, and limitations.
Peridynamic Theory: Concept of PD, PD states, PD form of deformation gradient, force density, PD form of strain energy density function, classification of PD equations of motion, surface effects, boundary conditions, and limitations.
PD Differential Operator (PDDO): PD functions and connection with PD theory
Unification of local and PD theory: PD equilibrium equations for homogeneous deformation, PD form of local equilibrium and traction equations, imposition of boundary conditions
Failure prediction: Bond breakage, local damage measure, critical stretch, kinetic theory of fracture for fatigue.
Numerical Implementation: Spatial discretization, family search, explicit and implicit solution
Modeling Material Nonlinearity: J2 Plasticity model
PD-FE coupling: Direct coupling with finite elements in ANSYS

Target audience: doctoral students, non-academic professionals.

Dates and time: 10/11/12/13 July 2023, 9.00 - 16.00*
* The schedule may vary and will be confirmed on a daily basis.

REGISTRATION AND CONTACTS

Course Code: 20230710-13

This course is part of the 2023 institutional activity for AIDAA members. The registration requires the purchase of one of the packages described here https://www.aidaa.it/package-list/, and the completion of the online form available on AIDAA webpage.

Course platform: Webex, a link will be sent via email as the registration is complete.
At the end of each course, **attendance certificates** will be sent to participants via email.

For further info, please, contact **academy@aidaa.it**

SPEAKER

Erdogan Madenci has been a professor in the Department of Aerospace and Mechanical Engineering at the University of Arizona since 1989. He received his B.S. degrees on both Mechanical and Industrial engineering, and his M.S. degree in Applied Mechanics from Lehigh University, Bethlehem, Pa in 1980, 1981, and 1982, respectively. He received his Ph.D. degree in Engineering Mechanics from UCLA in 1987. Prior to joining the University of Arizona, he worked at Northrop Corporation, Aerospace Corporation, and the Fraunhofer Institute. Also, he worked at the KTH Royal Institute of Technology, NASA Langley Research Center, Sandia National Labs and MIT as part of his sabbatical leaves. He is the lead author of five books on Peridynamics (available in Chinese) and Finite Element analysis. He serves as the Co-Editor-in-Chief of the Journal of Peridynamics and Nonlocal Modeling and an Associate Editor of ASME Open Journal of Engineering. He is a Fellow of ASME and an Associate Fellow of AIAA.