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Manufacturing Analysis Using Advanced FEM and Meshfree Methods

Instructors: C. T. Wu (LSTC) or W. Hu (LSTC)
2 Days - $400 Students $200 w/student ID
Includes on site continental breakfasts, lunches, breaks, class dinner
Includes 30-day LS-DYNA demo license to practice

Prerequisite: Students should be familiar with LS-PrePost, have a command of the LS-DYNA keywords and options associated with meshfree methods.

Description: This two-day class covers various Meshfree and advanced FEM methods for manufacturing application. The class will provide the fundamental background, the related LS-DYNA keywords, practical applications and their latest developments. Benchmarks are presented in the workshop as demonstrations for training purpose.

Course contents

[1] **Adaptive Finite Element and Element-free Galerkin Methods:** While adaptive FEM method can efficiently handle the large material deformation, adaptive EFG method is developed for high gradient problems. The adaptive methods offer several useful features including local refinement, interactive adaptivity, thermal-mechanical coupling and manual element removal for many challenging forging and extrusion simulations. Both explicit and implicit analyses are available.

[2] **Smoothed Particle Galerkin (SPG) Method**: This method is developed for the semi-brittle and ductile failure analyses in solid mechanics applications. A strain-based failure criterion is utilized to model metal failure in various manufacturing processes. Emphases will be focused on metal milling, cutting, piercing, riveting, screwing and other material jointing simulations. This method can be used to bridge the Lagrangian finite element method and is only available in LS-DYNA.

[3] **Meshfree enriched Finite Element Method (ME-FEM):** This method works for near-incompressible 3D solids such as metal and rubber-like materials. The 5-noded solid element has been shown to satisfy the inf-sup stability condition and generate a smoothed pressure field. This method is only available in LS-DYNA.

[4] **Element-free Galerkin (EFG) Method:** The method works for solids and shells in crashworthiness and manufacturing applications. Particular interest applies to deformable foam and general shell structures. Compared to the conventional FEM, EFG is more effective in dealing with large material deformation and high gradient solution.