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Implicit Analysis using LS-DYNA®

Instructor: **Dr. Nils Karajan**

2 Days - $400, Students $200 w/student ID
Includes on-site continental breakfasts, lunches, breaks, class notes, class dinner
Includes 30-day LS-DYNA® demo license to practice

Prerequisite: Attendees should have a basic knowledge of LS-DYNA®

Objective: The aim of the seminar is to give attendees an overview of the possibilities and limits of implicit simulations using LS-DYNA®.

Description: In recent years, the simulation possibilities in LS-DYNA® using implicit time integration have been enhanced extensively. Some areas of application for implicit analyses include linear and non-linear static and transient dynamic computations, natural frequency analyses, springback and initialization of systems with preload. Good scalability is observed on many CPU cores, which allows for the treatment of large scale problems with millions of unknown degrees of freedom.

The course is recommended for all intending to use LS-DYNA® to carry out implicit simulations. Examples will be given during the seminar to illustrate the functionality of the implicit options.

Contents:

- Introduction to the implicit solver
  - Theory and differences to explicit time integration
  - Overview on implicit analysis types, applications and involved implicit control keywords
- Linear static analysis
  - Options, linear elements, boundary constraints, direct/iterative solver settings, memory, accuracy
- Dynamic implicit analysis
  - Available time integration schemes (Newmark, Bathe, Hilber-Hughes-Taylor)
  - Switching between dynamic and static analysis, Input parameters, lumped/consistent mass matrix
- Nonlinear implicit static and dynamic analysis

  - Origins of nonlinearity and differences to linear analysis
  - Nonlinear solution procedure: Newton based schemes, BFGS
  - Convergence, tolerances, output, automatic and manual time step control
- Eigenvalue analysis: options, modeling aspects, intermittent output
- Modal analysis, linear buckling
- Nonlinear buckling with arclength solvers
- Frequency response function
- Switching time integration scheme: implicit/explicit, explicit/implicit
- Element types for linear and nonlinear analysis
- Material models for implicit analyses
- Contact types for implicit: options, tied contacts, sliding contacts with Mortar option
- Troubleshooting convergence problems, Tips and tricks
- Miscellaneous: Pre-stress, thermal load, performance, etc.
- Final guidelines with checklist of most important settings for implicit calculations