



LS-DYNA Material Modeling Using Usermat

A short course taught by: Ala Tabiei, Ph.D.

Class Location: **Livermore Software Technology Corporation**
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Objective of the course

This user-defined subroutines in LS-DYNA allow the program to be customized for particular applications. The usermat allow constitutive models to be added to the program. This course explains and demonstrates when to consider the use of such user subroutines and how to go about their developments. Detailed descriptions are given of the data required for the usermat, the additional statements to be included, the variable that are available within the subroutine, and the freedom the user has in defining complex material models. Examples of various user subroutines and flow charts are used to illustrate the points made in the lectures.

Who should attend

This course is recommended for engineers with LS-DYNA and DYNA3D experience as well as knowledge in some programming in FORTRAN or any other language and the finite element method.

Lectures begin daily at 9:00 a.m. and run until 5:30 p.m. The classroom machines are PCs running on the Linux operating system.

COURSE CONTENTS:

- The Nonlinear Finite Element Dynamic Equations
- Introduction to Inelasticity and Plasticity
- HOW TO GO ABOUT WRITING USERMAT AND COMMON PRACTICE
- USERMAT INTERFACE AND USERMAT VARIABLES
- USERMAT CONVENTIONS
- USERMAT FORMULATION ASPECTS
- USER DEFINED MATERIAL SUBROUTINES
 - Isotropic Material
 - Elastic material (beam, shell, solid)
 - Elastic plastic-kinematic-isotropic (shell, solid)
 - Strain rate effect
 - Orthotropic Material
 - Damage modeling
 - Composite macromechanics and micromechanics with progressive damage
 - Bio-Materials
 - Tissue modeling
 - Hyperelastic material and rubber
 - Viscoelastic material
- Available variables in UMAT
- How to post process UMAT in LSPOST
- Several examples will be demonstrated
- User defined mat in Implicit LS-DYNA