

# LS-DYNA® TRAINING

By Predictive Engineering

Implicit and Explicit Nonlinear Transient Analysis for Structural Mechanics



**Duration:** 32 hours (four, 8-hr sessions)  
**When:** May 1 to 4 (Monday to Thursday), 2023  
**Where:** Portland, Oregon, USA (live, in-person)  
**Cost:** \$3,850.00

**Optional Day:** May 5 (Friday) – Troubleshooting nonlinear implicit analyses to achieve quick and accurate convergence.  
**Duration:** 5 hours, 8:00 am to 1:00 pm with 15 min break at 10:30 am.  
**Cost:** \$690.00

**What's Included:** Printed class notes and complete digital course content (class reference notes and workshops). Laptops with LS-DYNA license can be provided for an additional \$645/student. Otherwise, it is expected that students will have their own laptops with access to an LS-DYNA license. This course qualifies for 32-hrs of professional continuing education credits.

**Know Your Class:** Monday – Evening social and dinner 5:00 to 8:00 pm. This event is hosted by Predictive Engineering.

**Registration:** Early registration is encouraged since space is limited to 15 students and it is expected that the class will fill. Class hours are 8:00 am to 5:00 pm with 15 min breaks at 10:00 am and 3:00 pm and 45 minutes for lunch.

To register please send email to:  
[Training@PredictiveEngineering.com](mailto:Training@PredictiveEngineering.com)  
Attn: George Laird, PhD, PE

**About Predictive Engineering**  
Based in Portland, Oregon, Predictive has 20+ years of experience with LS-DYNA sales, training, and consulting. References available at our website:  
[www.PredictiveEngineering.com](http://www.PredictiveEngineering.com)



## Engineering Short Course

This short course is directed toward the engineering professional simulating highly nonlinear static and transient dynamic problems involving large deformations and contact between multiple bodies. Our goal is to provide a broad foundational knowledge of LS-DYNA which can be built upon towards practical individualized usage. Class materials are drawn from our extensive and diverse simulation experience over more than 20+ years.

The course is fast paced and follows the scientifically proven method that flows from lecture (theory) to hands-on examples (workshops). All workshops are provided in video format for later review by the students.

## Course Outline

### Theoretical Foundation

- I. Implicit versus Explicit
- II. Understanding LS-DYNA Keywords and Format (Workshop)
- III. Explicit Time Step - CFL (Workshop)
- IV. Mass Scaling – CMS/SMS (Workshop)
- V. Meshing for Explicit Success (Workshop)
- VI. Explicit Element Technology (Workshop)

### LSPP & Material Modeling

- I. LS-PrePost Philosophy (Workshop)
- II. Material Modeling: Metals, Elastomers, Foams (Workshop)
- III. Equation of State (EOS)
- IV. Material Failure & Fracture (Workshop)
- V. Rigid Bodies (Workshop)

### Contact & Load Initialization

- I. Contact Theory & Application (Workshop)
- II. Edge-to-Edge Contact & Other Pathologies (Workshop)
- III. Tied-Contact: Mesh Transitions, Gluing, Welding (Workshop)
- IV. Negative Sliding Interface Energy (Workshop)
- V. Implicit-to-Explicit Switching: Load Initialization (Workshop)

### Drop Test, Damping & Bird Strike (SPH)

- I. Dynamic Relaxation for Bolt Preload (Workshop)
- II. Damping (Workshop)
- III. Drop Test Simulation (Workshop)
- IV. Smoothed Particle Hydrodynamics (Workshop)
- V. Bird Strike / Ballistic Impact (Workshop)

### Implicit Analysis: Linear to Nonlinear to Dynamics

- I. Observations on Implicit versus Explicit Analysis
- II. Implicit analysis: Linear, Static Stress Analysis (Workshop)
- III. Nonlinear Implicit Analysis with Mortar Contact (Workshop)
- IV. Troubleshooting Nonlinear Implicit Analyses (Workshop)
- V. Normal Modes Analysis, Sine Sweep and PSD Analyses
- VI. PSD Analysis with Fatigue Assessment (Workshop)
- VII. Q&A

### Optional Extra Day: Troubleshooting Implicit Analyses

- I. Understanding implicit convergence indicators
- II. Techniques to quickly achieve convergence (Workshop)
- III. When nothing else works – Diverging Solution (Workshop)
- IV. Best Practices from Start-to-Finish (Workshop)
- V. Assigned Student Homework with Instructor Follow-Up