

# Application of Rubber Fatigue Analysis with Endurica Software

For many companies, validating the service life for an elastomeric product is the most time-consuming and expensive stage of the product development process. The physical testing requires investment in prototypes that will be destroyed and lengthy trials that execute on expensive equipment. This course shows how Endurica software can be applied to virtually evaluate fatigue performance and solve design issues at the concept stage. After completing this course you will be ready a Fatigue Ninja, empowered to use the software to diagnose and solve fatigue issues.

## Course Objectives

### Objectives

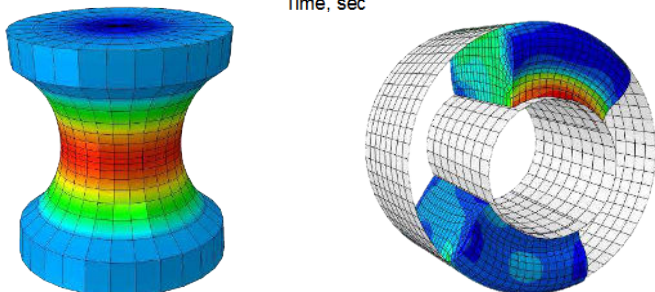
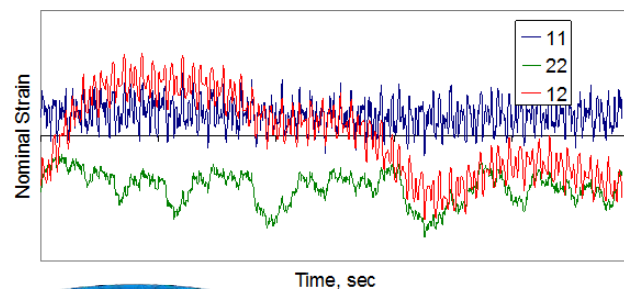
- Understand key principles governing fatigue in elastomers
- Select and specify material models that accurately describe elastomer behavior
- Apply fatigue analysis workflows for
  - Infinite life analyses
  - Safe life analyses
  - Damage tolerant analysis
- Successfully solve durability issues using Endurica software (CL, DT and EIE)

### Format

The course features lectures and hands-on exercises focused on specifying, executing and interpreting numerical simulations of fatigue behavior.

### Instructor

Dr. Will Mars is an international authority on damage mechanics in elastomers. He brings three decades of experience developing product testing and simulation methods in the rubber industry.



## Outline

### Day 1: Fatigue Life Simulation Basics with Endurica CL

- Software installation
- Overview of Fatigue Analysis Workflows
- Managing Duty Cycle: Setting up the Finite Element Analysis
- Fatigue Analysis principles
  - Fracture Mechanics
  - Critical Plane Analysis
  - Rainflow counting / Damage accumulation
- Exporting strain history
- Material behavior, part 1
  - Elastic behavior
  - Crack growth behavior
  - Calibrating the crack precursor size

### Day 2: Common Workflows with Endurica CL

- Material behavior, part 2
  - Mean strain effects and strain crystallization
  - Self heating
  - Specifying temperature effects
  - Ozone attack
- Infinite Life Analysis workflow
- Safe Life Analysis workflows

### Day 3: Incremental Workflows with Endurica DT

- Specifying Complex Duty Cycles: Steps, Blocks and sequence effects
- Damage tolerant analysis workflows
- Specifying Block cycles
- CoSimulation for Ageing and Cyclic softening

### Day 4: Working with Real-time, multi-channel load history: Endurica EIE

- Managing road loads
- 1D and 2D problems
- 3D-6D – working in higher dimensions
- Channel Reduction
- Building a map of the load space
- Load interpolation
- Signal defeaturing and block cycle extraction



## Registration Form: Application of Rubber Fatigue Analysis with Endurica Software

2023 Course Dates \_\_\_\_\_ May 23-26, 2023 or \_\_\_\_\_ December 4-7, 2023

Price: \$1,595.00 \*USD

\*for registrations received 14 days prior to course date. Registration after this date incurs a late fee of \$250.

Mail, fax or e-mail this form to

Attention: Joe Suter, [jasuter@endurica.com](mailto:jasuter@endurica.com)

Fax: 567-429-7034

Endurica LLC  
1219 West Main Cross, Suite 201  
Findlay, Ohio 45840 USA

Name \_\_\_\_\_

Company Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Email \_\_\_\_\_ Work Phone \_\_\_\_\_

Payment Method:

PO No. \_\_\_\_\_ Credit Card Type:  VISA  MasterCard  American Express

Card No. \_\_\_\_\_ Card CVV No. \_\_\_\_\_

Cardholder Name \_\_\_\_\_ Exp. Date \_\_\_\_\_

Card Billing Street Address \_\_\_\_\_

Card Billing ZIP Code \_\_\_\_\_

Signature: \_\_\_\_\_

Or, write a check payable to Endurica LLC.

Endurica LLC reserves the right to cancel a scheduled training course if the minimum class size is not met. In the event of a cancellation, Endurica LLC will make every attempt to notify registered participants within five working days. Payment made for a canceled course will be refunded in full or applied to another scheduled training course.

Participant cancellations must be received at least 10 working days in advance. Registrations canceled by participants less than 10 working days before the training course begins are subject to a 50% cancellation charge. For cancellations occurring on the first day of a scheduled training course, and for "no shows," the full tuition fee is non-refundable.

Endurica LLC • [www.endurica.com](http://www.endurica.com)  
1219 West Main Cross, Suite 201 • Findlay • Ohio • 45840 • USA  
Phone: (+1) 419-957-0543 • Email: [info@endurica.com](mailto:info@endurica.com)