



VERYST ENGINEERING, LLC  
 47A Kearney Road  
 Needham, MA 02494

## ABOUT THE COMPANY

Located in the Boston area, Veryst Engineering®, LLC is an engineering consulting firm providing services in product design, manufacturing processes, and failure analysis.

Veryst provides premium engineering and consulting services to companies nationwide.



VERYST  
 ENGINEERING, LLC

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[www.verystmedical.com](http://www.verystmedical.com)

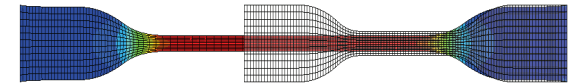
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 BROCKTON, MA



VERYST

## TRAINING CLASS

# FINITE ELEMENT MODELING OF POLYMERS



Do you perform FEA of polymer components but don't know the tradeoffs, pitfalls, and benefits of different constitutive models, modeling options, and material test methods?

Do you want to get a **competitive advantage** by using more advanced and accurate FEA techniques?

TUESDAY, NOVEMBER 17

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WEDNESDAY, NOVEMBER 18, 2009

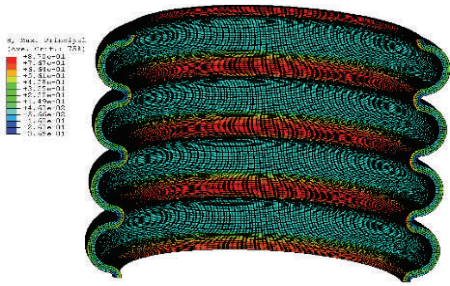
8:30 A.M. — 4:30 P.M.

Galleria Park Hotel  
 191 Sutter Street  
 San Francisco, CA 94101

ENGINEERING THROUGH THE FUNDAMENTALS.

Tel: 781- 433- 0433

# FINITE ELEMENT MODELING OF POLYMERS



This two-day training class covers a review of polymer mechanics theory, techniques and tools for experimentally characterizing polymers, and hands-on training on how to perform accurate finite element simulations of polymer components. The training class is targeted to people with an interest in designing and analyzing the mechanical performance of parts made from plastics, rubbers, thermosets, or other types of polymers.

## PREREQUISITES

The training class is intended for people with some experience running finite element programs. The examples presented in class will use the commercial finite element program ABAQUS. This course is applicable to all finite element codes and is not limited to ABAQUS implementations.

The training class will use the textbook “An Introduction to the Mechanical Properties of Solid Polymers” by I.M. Ward, et al. The textbook will be provided to all class participants at no additional charge. In addition, multiple handouts will be provided.

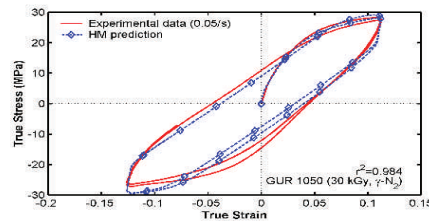
## LEARNING OBJECTIVES

By the end of the class you will be able to:

- Design a relevant experimental test program for a new polymer material.
- Know the strengths and weaknesses of various material models, and be able to select an *appropriate* material model for finite element simulations.
- Use experimental data to calibrate the selected material model.

## COURSE OUTLINE

- Review of polymer mechanics
- Modern mechanical testing techniques for polymers
- Finite element analysis as an engineering tool
- Differences between polymers and metals
- Continuum mechanics review: stress, strain, deformation gradients, invariants, balance laws
- Elasticity/hyperelasticity: review of hyperelastic models
- Review of viscoelasticity theory: strengths and limitations of linear viscoelasticity
- Review of metal plasticity theory: strengths and limitations of metal plasticity models
- User-material models in ABAQUS, including advanced viscoplastic constitutive models incorporating rate and temperature dependence
- State variable models
- Failure predictions of polymers
- Advanced finite element simulations of different classes of polymers
- Material parameter extraction techniques



## ABOUT THE INSTRUCTOR

Dr. Bergstrom is a Managing Engineer at Veryst Engineering® LLC, and consults primarily in the modeling, testing, and failure analysis of mechanical behavior of polymeric materials. Dr. Bergstrom received his Ph.D. from M.I.T. in the area of computational polymer mechanics, and is a Lecturer in the Department of Mechanical Engineering at M.I.T. To learn more about Dr. Bergstrom and Veryst Engineering, LLC, visit our website at: [www.veryst.com](http://www.veryst.com).

REGISTRATION—Finite Element Modeling of Polymers—November 17 & 18, 2009

### To Register

Fax: (781) 433-0933—attn: Robin Vincent  
Scan & Email to: [rvincent@veryst.com](mailto:rvincent@veryst.com)  
Mail: Veryst Engineering, 47a Kearney Road, Needham, MA 02494  
Class is limited to 40 people.  
Deadline for course registration is October 30, 2009  
(415) 781-3060

We are pleased to offer a reduced guest room rate at the Galleria Park hotel.

To take advantage of the savings, please reserve with the hotel no later than October 18, 2009, and mention that you are with the Veryst group.

### Method of Payment

- Check (payable to: Veryst Engineering)
- Visa
- MasterCard
- American Express

Class Fee: \$1600

### Class Participant Information

Name: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: Street \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Email: \_\_\_\_\_ Phone: \_\_\_\_\_

### Cardholder Information

Name on Card: \_\_\_\_\_  
Credit Card # \_\_\_\_\_  
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