



OSU PROFESSIONAL DEVELOPMENT PROGRAM ENGINEERING & BUSINESS MODELING, OPTIMIZATION AND CONTROL

Description

This program is a collection of three individual short courses: Nonlinear Optimization Techniques for Engineering, Nonlinear Regression Modeling, and Applied Probability and Statistical Methods. These courses provide an exploration of statistics, regression modeling, and optimization for comparing treatments, developing models, using models for process and product improvement, and analyzing and reporting uncertainty in decisions grounded in data and models.

Who Should Attend

These courses are designed to develop and improve essential data analysis skills for practicing engineering employees and students, new faculty, scientists, and engineers.

Presented by

Russ Rhinehart, Emeritus Professor
OSU School of Chemical Engineering

Dr. R. Russell Rhinehart has experience in both industry (13 years) and academe (30 years). He served as Head of the School of Chemical Engineering at Oklahoma State University for 13 years and retired in 2016 to shift his a career toward professional education. Russ also served as president of the American Automatic Control Council, and Editor-in-Chief of ISA Transactions.



Dr. Rhinehart is a Fellow of ISA, a CONTROL Automation Hall of Fame inductee, and received numerous teaching and innovation recognitions. He authored six handbook chapters on modeling, uncertainty, process control, and optimization; and has developed a web site to support his aim to focus and disseminate best-in-class public-domain techniques for modeling, optimization, and control.

Visit his Websie at: <http://www.r3eda.com/>



COLLEGE OF ENGINEERING, ARCHITECTURE AND TECHNOLOGY

Professional Development

Nonlinear Optimization - Techniques for Engineering

Optimization means seeking the best outcome or solution, and is a fundamental tool for modeling, model-based control, forecasting, process and product design, analysis and diagnosis, supervisory economic operation, safety, precision, sustainability, and more.

This two-day course provides guided instruction and hands-on application to explore optimization software and address major challenges in optimization. This course will cover common gradient based optimization techniques (Incremental Steepest Descent, Cauchy Sequential Line Search, Newton, Levenberg Marquardt, and Solver's GRG) and direct search techniques (Heuristic, Hook Jeeves, Particle Swarm, Leapfrogging, and Genetic Algorithms), and both single and multi-objective applications (Pareto Optimal).

Objectives

As a practical guide for those using multivariable, constraint handling, and nonlinear optimization, participants will:

- Define the objective function (cost function)
- Incorporate constraints (either hard or appropriately weighted penalties)
- Choose an appropriate optimizer for application
- Choose appropriate convergence criteria and thresholds
- Choose initialization and number of trials to find global optimum

Course Material

Participants will receive the textbook and software with exercises and access code. Exercises and code can be implemented in any environment, but MS Excel/VBA will be used as in workshop examples and exercises. There are currently more than 50 functions, 14 optimization algorithms, and over a dozen convergence criteria options in the simulator. Participants can, and have permission to, directly apply the provided software to their specific problems in industry. Participants are invited to bring a computer with Excel 2010.

Textbook

Engineering Optimization: Applications, Methods, & Analysis; 2018, John Wiley & Sons. (Textbook provided).

Course Schedule

OSU-Tulsa 2/21/19 - 2/22/19

Registration

- Individual classes: \$559 per class per participant
- Register for all three classes together for only \$1,425 per participant
- Register online at: ceatpd.okstate.edu/content/engineering-and-business-modeling-optimization-and-control
- To register by phone, call: (405)744-5714

Registrations may be canceled five (5) business days prior to the start of the course and receive a full refund. Within 5 days prior to the start of the course, registrants that cancel will be responsible for 25% of the course fee. Registrants that have paid and cancel without proper notification will receive a 75% refund. The registrants who fail to attend the course without any prior notification will be responsible for the full course fee. Substitutions may be made at anytime without penalty prior to the course starting date. In the event that OSU has to cancel a course, OSU will not be responsible for any cancellation charges assessed by airlines, travel agencies, hotels, etc... Pricing includes course materials, morning and afternoon refreshments.

Nonlinear Regression Modeling

Models based on data are often central for model based control, forecasting, training simulators, analysis and diagnosis, mechanism validation, design scale-up, and supervisory optimization. Models support both product and process development, analysis, and design. For many applications, nonlinear models are preferred in order to capture the process or device behavior.

The Nonlinear Regression Modeling course is designed to provide a better understand of regression applications, along with practical best practices from conventional methods with examples from many disciplines to illustrate optimal choices and techniques.

Objectives

This two-day course provides guided instruction and hands-on application for nonlinear regression modeling, with a focus on developing both static and dynamic models. Participants will:

- Choose appropriate concepts for defining the regression objective
- Choose an optimization approach and criteria for convergence
- Apply both databased and logical criteria for model validation and model discrimination
- Apply both batch and recursive model parameter evaluation
- Design experiments for data generation that support model validation
- Select appropriate model design considering order/complexity and in-use utility
- Estimate model uncertainty based on data variability

Course Material

Participants will receive software with solutions to in-class exercises, course notes, and course textbook.

Participants are invited to bring a computer with Excel 2010 or higher.

Textbook

Nonlinear Regression Modeling for Engineering Applications: Modeling, Model Validation, and Enabling Design of Experiments, by Rhinehart; 2016 Wiley.
(Textbook provided).

Course Schedule

OSU-Tulsa

3/14/19 - 3/15/19

Course Details: <https://ceatpd.okstate.edu/node/176>

Applied Probability and Statistical Methods

Experimental data has uncertainty, yet we must use it to make decisions. Applied probability and statistics provides the techniques to assess confidence in a decision and to choose the number of replicates needed to ensure a desired confidence.

This two-day course provides guided instruction and hands-on application to explore best practices from conventional methods with examples from many disciplines to illustrate optimal choices and techniques.

Objectives

Gain a practical guide for statistical methods useful for engineering and business. In this course, participants will:

- Evaluate data in terms of appropriate distribution and its metrics
- Evaluate experimental results and compare treatments
- Explore “reject” and “accept” and associated Type-I and Type-II errors
- Assess and represent uncertainty in data and in modeling results
- Choose appropriate statistical tests for the application attributes

Course Material

Participants will receive software with solutions to in-class exercises, course notes, and course textbook.

Participants are invited to bring a computer with Excel 2010.

Textbook

Applied Engineering Statistics, by R. M. Bethea and R. R. Rhinehart; Chapman & Hall/CRC, Boca Raton, FL (originally Marcel Dekker, Inc., New York, NY).
(Textbook provided).

Course Schedule

OSU-Tulsa

04/25/19 - 04/26/19

Course Details: <https://ceatpd.okstate.edu/node/177>

Registration

- Individual classes: \$559 per class per participant
- Register for all three classes together for only \$1,425 per participant
- Register online at: ceatpd.okstate.edu/content/engineering-and-business-modeling-optimization-and-control, or call: (405)744-5714