

Process Yield Optimization & Energy Conservation

Course Description:

Optimization is widely used in engineering, science and business. Typical applications of optimization include process design, process control, planning and scheduling, and model building.

This course will provide the participant with the ability to efficiently formulate and solve engineering optimization problems. Relevant engineering examples will be discussed in the course, which will emphasize the use of computational software, such as MATLAB, to solve optimization problems.

Course Objectives:

Upon completion of this course, the students should be able to:

- Formulate optimization problems
- Select appropriate algorithms and software packages to solve optimization problems
- Analyze and interpret the solution of an optimization problem

PROGRAM CONTENTS

PART I: Problem Formulation

1- The Nature and Organization of Optimization Problems

- 1.1 What Optimization Is All About
- 1.2 Why Optimize?
- 1.3 Scope and Hierarchy of Optimization
- 1.4 Examples of Applications of Optimization
- 1.5 The Essential Features of Optimization Problems
- 1.6 General Procedure for Solving Optimization Problems
- 1.7 Obstacles to Optimization

2- Developing Models for Optimization

- 2.1 Classification of Models
- 2.2 How to Build a Model
- 2.3 Examples of Inequality and Equality Constraints in Models

3- Formulation of the Objective Function

- 3.1 Economic Objective Functions
- 3.2 The Time Value of Money in Objective Functions
- 3.3 Measures of Profitability

Part II: Optimization Theory and Methods

4- Linear Programming (LP) and Applications

- 4.1 Geometry of Linear Programs
- 4.2 Basic Linear Programming Definitions and Results
- 4.3 Simplex Algorithm
- 4.4 Barrier Methods
- 4.5 Sensitivity Analysis
- 4.6 Linear Mixed Integer Programs
- 4.7 LP Software

5- Nonlinear Programming with Constraints

- 5.1 Direct Substitution
- 5.2 Quadratic Programming
- 5.3 Successive Quadratic Programming
- 5.4 The Generalized Reduced Gradient Method
- 5.5 Relative Advantages and Disadvantages of NLP Methods
- 5.6 Available NLP Software
- 5.7 Using NLP Software

Part III Applications of Optimization

6- Heat Transfer and Energy Conservation

- Example 6.1 Optimizing Recovery of Waste Heat
- Example 6.2 Optimal Shell-and- Tube Heat Exchanger Design
- Example 6.3 Optimization of a Multi-Effect Evaporator
- Example 6.4 Boiler/Turbo-Generator System Optimization

7- Separation Processes

- Example 7.1 Optimal Design and Operation of a Conventional Staged-Distillation Column
- Example 7.2 Determination of the Optimal Reflux Ratio for a Staged-Distillation Column

8- Fluid Flow Systems

- Example 8.1 Optimal Pipe Diameter
- Example 8.2 Minimum Work of Compression
- Example 8.3 Economic Operation of a Fixed-Bed Filter
- Example 8.4 Optimal Design of a Gas Transmission Network

9- Chemical Reactor Design and Operation

- Example 9.1 Optimization of a Thermal Cracker
- Example 9.2 Optimal Design of an Ammonia Reactor
- Example 9.3 Solution of an Alkylation Process

10- Optimization in Large-Scale Plant Design and Operations

- 10.1 Process Simulators and Optimization Codes
- 10.2 Optimization Using Equation-Based Process Simulators
- 10.3 Optimization Using Modular-Based Simulators

11- Integrated Planning, Scheduling, and Control in the Process Industries

- 11.1 Plant Optimization Hierarchy
- 11.2 Planning and Scheduling
- 11.3 Plantwide Management and Optimization

Who Should Attend

This course is particularly useful to all individuals currently studying/working (or intend to take up employment) in disciplines such as engineering/ medicine/sciences/business with particular interests in data analysis. Engineers will also find it useful to obtain a basic knowledge for process monitoring, vibration monitoring, etc. A practical engineer can directly employ the techniques taught in this course to analyze process data with applications to controller performance assessment, plant-wide oscillation detection, time-delay estimation, etc.

For any further information please contact us at:

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