

## OPTIMAL ENGINEERING DESIGNS – METHODS & APPLICATIONS

May 22–26, 2010

### COURSE DESCRIPTION

It is well known that a typical engineering design process is often imbued by a set of conflicting requirements that should be satisfied optimally for specified design objectives. This would normally entail satisfaction of economic, safety and serviceability criteria. It is *also* well known that the building of any engineering structure, process, or facility involves three basic stages (including: initial design stage, engineering analysis stage and *the* final design stage), that are *repeatedly refined* until the design objectives, design restrictions (constraints), and economical restrictions are satisfied as closely as possible. For complex engineering problems the solution process is *often* a formidable task that can be solved efficiently only through systematically automated procedures. For this purpose the tools of engineering analysis and mathematical programming should be *interfaced* to create the engineering model and systematically search for the best (optimal) engineering solution. This short course will introduce the participants to the recent tools of Engineering Analysis and the methods of *interfacing* these tools with the search tools of Mathematical Programming to find *optimal* solutions. Based on the premise that engineering problems are *invariably* multi-disciplinary whose solutions require coordinated efforts of engineering team members with different engineering backgrounds. This course will *enable* participating engineers to gain practical skills to simulate and solve multi-disciplinary engineering problems using the tools of mathematical programming.

### COURSE OBJECTIVES

Upon completing the course, each participant will have *adequate* capabilities to formulate and solve engineering design problems using the available tools of automated mathematical programming when interfaced with the finite element method.

### COURSE OUTLINE

The short-course includes the following main topics:

- ❖ Overview of the process of engineering design optimization, its applications, and the tools of mathematical programming.
- ❖ Classifications of engineering design

problems optimization (LP vs. NLP problems).

- ❖ Formulations of the design problems.
- ❖ Essential elements of linear programming.
- ❖ Applications of linear programming. To solve typical engineering design problems.
- ❖ Essential tools of NLP to solve engineering design problems.
- ❖ Search procedures for optimal engineering solutions.
- ❖ Computational considerations for solving large scale design problems.
- ❖ Automation of the search procedures and their applications for optimal solutions.
- ❖ Basics of the Finite Element Method (FEM-based GENESIS) solutions.
- ❖ Interfacing the FEM and the tools of mathematical programming.
- ❖ Computer applications using recent automated analysis/design codes: design applications.

### COURSE FORMAT

The course materials will be presented in four daily sessions. The daily sessions of the course will include a combination of lectures, group discussions, and analysis and design case studies *with* and *without* computer applications.

### CLASS SCHEDULE

Sessions of the course are held from Saturday to Wednesday, 22-26 May, 2010. Daily, the first session starts at 8:00 a.m. and the last session ends at 3:00 p.m. The schedule will include 30 minutes breaks for refreshments in the morning and afternoon, and one 1½ - hour lunch break.

### LOCATION

Sessions of the course will be held in building 54 (Auditorium 001). Computer tutorial sessions will be held in the Information Technology Center laboratory ITC-256.

### FACULTY

The course will be taught by selected faculty-members of the departments of Civil, Mechanical and Systems Engineering at *King Fahd University of Petroleum & Minerals*, Dhahran, and one highly qualified senior engineer with *relevant* industrial experience from Vanderplaats Research and Developments in the USA. The faculty members of the course have *the necessary diversified* experiences in teaching, research and relevant industrial applications.

## CERTIFICATES

The College of Applied Engineering at KFUPM will award the short-course certificate to each participant who successfully completes 80 percent of the sessions itemized in the short-course outline.

## COURSE FEE

The course registration fee is SR 8000 per participant for *early* registration. The fee will cover all course materials, including notes, some design softwares, refreshments, daily lunch and graduation luncheon. Payments of the course fees should be made by certified checks payable to King Fahd University of Petroleum & Minerals, Dhahran.

## APPLICATIONS

Engineering Consultants, Designers, Practicing Engineers [with Engineering Degree (B.Sc. or its equivalent)] are eligible to complete the attached application form and return it to:

### Deanship of Education Services & Continuing Education Programs

King Fahd University of Petroleum & Minerals  
KFUPM Box 5026  
Dhahran 31261, Kingdom of Saudi Arabia  
Phone: (03) 860-1234/2981/3998  
FAX: (03) 860-4770/2341

For planning purposes, the application forms should be processed as soon as possible *but not later* than Monday 10<sup>th</sup> May, 2010 in order to qualify for the *normal* registration fees for the short-course.

## GENERAL INFORMATION

Extra information about the course can be obtained from the course *coordinator*:

### Dr. Saeid A. Alghamdi

Department of Civil Engineering  
King Fahd University of Petroleum & Minerals  
KFUPM Box 1896  
Dhahran 31261, Saudi Arabia  
Phone: (03) 860-2570 or (05) 480-3357  
FAX: (03) 860-2570 or (03) 860-2987  
e-mail: [saghamdi@kfupm.edu.sa](mailto:saghamdi@kfupm.edu.sa)

The coordinator will provide timely updates of the planning for the course.

## TRAVEL AND ACCOMMODATION

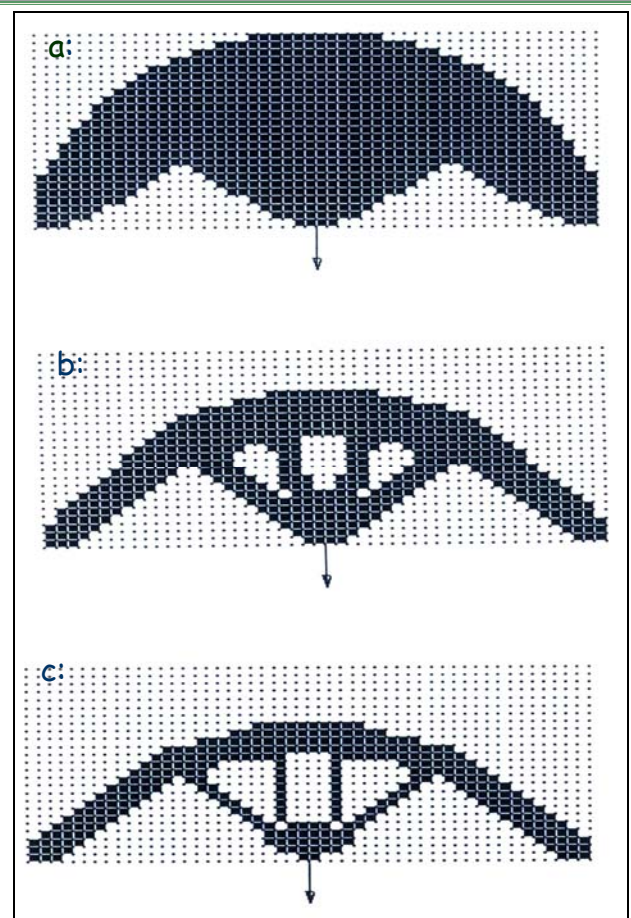
Prospective participants should make arrangements for their travels and accommodations as the course fee *does not* include boarding and lodging. The

public relations office at *King Fahd University of Petroleum & Minerals* has however made arrangements for discounted rates with several local hotels. Each course-participant may call either one of the following hotels:

- Ramada Hotel-Dhahran [Phone: 03-891-5444].
- Dhahran International Hotel [Phone: 03-894-8555].
- The Meridian-Khobar [Phone: 03-864-6000]

For additional information and more guidance you may also call the public relations office at KFUPM on Phone 03-860-3100.

### EVOLUTION OF A SAMPLE STRUCTURAL DESIGN



### Typical search for an optimal structural shape:

(a) Initial Design; (b) Intermediate design; (c) Final design.

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