**ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ**
**ΣΧΟΛΗ ΧΗΜΙΚΩΝ ΜΗΧΑΝΙΚΩΝ**

**ΕΠΙΤΡΟΠΗ ΣΕΜΙΝΑΡΙΩΝ, Καθηγητής Α. Κοκόσης**

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ΣΕΜΙΝΑΡΙΟ ΧΗΜΙΚΗΣ ΜΗΧΑΝΙΚΗΣ

Παρασκευή 20 Μαΐου 2011, 13:00
Αίθουσα Σεμιναρίων «Ν. Κουμούτσου»

Professor **Mahmoud M. El-Halwagi**

Holder of the McFerrin Professorship Texas A&M University

# Functionality-Based Process Design: Shifting from Mass Integration to Property Integration

Motivated by the complex and staggering nature of environmental problems, mass integration has evolved as a holistic approach to the generation, separation, and routing of species and streams throughout the process. It is a systematic methodology that provides a fundamental understanding of the global flow of mass within the process and employs it in identifying performance targets and optimizing the allocation and generation of streams and species. The presentation starts by discussing key concepts and tools in the area of mass integration and how this methodology can be used to provide global insights on the process performance. Special emphasis is given to the notion of targeting which enables the benchmarking of process performance ahead of detailed design.

Traditionally, mass integration techniques have been based on tracking individual chemical species. Component material balances have always been at the heart of any design approach. While the nature and quantity chemical constituents is important in characterizing and designing chemical processes, the question is whether or not it is essential to track them for all systems. Interestingly, the answer is no! There are many design problems that are not component dependent. Instead, they are driven by properties or functionality of the streams and not by their chemical

constituency. The second part of the presentation discusses the concept of process integration which is defined as a functionality-based, holistic approach to the allocation and manipulation of streams and processing units which is based on tracking, adjustment, assignment, and matching of functionalities throughout the process. In particular, the presentation will show systematic rules and visualization techniques for the identification of optimal mixing of streams, their allocation to units based on their properties, and task identification. Case studies will be used to illustrate the basic concepts and applicability. The presentation also includes a discussion on promising research directions in the area of property integration and its relationship to molecular design.