SOMER LECTURES PROGRAM

Prof. Dr. Tarık G. Somer (1926 - 1997)

Prof. Dr. Tarık G. Somer is the founder of Department of Chemical Engineering at Middle East Technical University (METU), and he is also the initiator of modern chemical engineering education in Turkey. After getting his B.S., M.S. and Ph.D. degrees from RPI, MIT and University of Maryland, he worked as a research engineer between 1954 - 1956.

He was appointed as the Professor and the founding chairman of the Department of Chemical Engineering at METU in 1957. He had worked as the President of METU and Ankara University between the years 1974 - 1976 and 1982 - 1987, respectively. He also served as the President of Council of Turkish Universities between 1984 - 1985. Being the chief technical advisor of UNESCO, he contributed to the establishment of the university system in Uganda. He also worked in Technische Hochschule Darmstadt as a Visiting Professor. Besides his memberships in a number of professional societies, he was also a member of Union of Presidents of European Universities Chemistry Research.

LECTURE 1:

Recent and Future Trends in Education and Research in Chemical Engineering

October 31, 2019, 14:00
Chemical Engineering Z-14

In this seminar, we give an overview of the evolution of chemical engineering knowledge starting from the concepts of conservation and unit operations, to the recent areas of biotechnology and nanotechnology. This has led to increased diversification in chemical engineering and an increased emphasis towards science. This trend in the U.S. has started to have an impact in chemical engineering education in the sense that there is a decreasing emphasis on chemical engineering fundamentals and systems engineering, at the expense on new molecular based and biology related courses. At the same time there seems to be an increased misalignment between industry and academia in that the demand of chemical engineers with traditional background in fundamentals remains very strong and well compensated. However, basic research in chemical engineering has greatly expanded its scope addressing problems from the molecular level (e.g. biomolecular) through the supply chain level (e.g. global distribution of chemicals). Furthermore, a refocusing of education and research has also been taking place recently due to the new trend towards sustainability and renewable energy systems (e.g. solar and biomass), which in fact requires the creative application of basic chemical engineering fundamentals. Finally, we close with a set of recommendations for chemical engineering education pointing out the need for keeping the core of chemical engineering courses while at the same time modernizing the curriculum, and promoting stronger interactions with industry.

Prof. Dr. Ignacio Grossmann

Ignacio E. Grossmann (B.S. Universidad Iberoamericana; M.S., Ph.D. Imperial College) is the R. R. Dean University Professor of Chemical Engineering at Carnegie Mellon, and member of the "Center for Advanced Process Decision-making." A member of the National Academy of Engineering, he has received many awards from AIChE and INFORMS, including the first Sargent Medal by the Institution of Chemical Engineers in 2015, and the distinction of being named “One of the Hundred Chemical Engineers of the Modern Era” by AIChE in 2008. He has honorary doctorates from Technical University of Dortmund, Abo Akademi, University of Maribor, University of Cantabria, Russian Kazan Technological University, University Nacional del Litoral and University of Alicante. His research interests are in mixed-integer, disjunctive and stochastic programming, energy systems, water networks, and planning and scheduling for enterprise-wide optimization. He has authored over 700 papers, and supervised 60 Ph.D. and 16 M.S. students.

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LECTURE 2:

Recent Advances in Computational Models for the Discrete and Continuous Optimization of Process and Energy Systems

November 1, 2019, 10:00
Chemical Engineering Z-17

In this seminar we give an overview of recent models and algorithms for the discrete and continuous optimization of a variety of challenging applications in Process Systems Engineering, in particular energy and water systems. We first provide a brief overview of optimization models based on mixed-integer linear/nonlinear programming (MILP/MINLP) to highlight the progress that has been made. We illustrate the application of large-scale MILP for hydrogen circular economy and apply it to a case study in the North of Spain. Next, we address the long range planning of electric power systems involving several sources, including coal, natural gas, nuclear power, solar and wind. Given the large-size of the multiperiod MILP model we describe a Nested-Benders decomposition method that can effectively solve large scale instances. We also make reference to the use of MILP for inventory control. We then illustrate the application of MINLP for the designing of shale gas infrastructures in which both design and planning decisions must be optimized simultaneously. MINLP applications are also described for process intensification in separation processes, and optimization of materials design. Next, we provide a brief review of global optimization for which the progress is illustrated with the synthesis of integrated water networks that involve recycle and reuse of water. We also show how some of these methods can be applied to protein design. We then briefly review Generalized Disjunctive Programming techniques and illustrate their application in the design of centralized and distributed manufacturing facilities, which is applied to a case study for biomass production. Finally, we show how uncertainty can be accounted in cryogenic energy storage and individualized medicine.

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October 31-November 1, 2019
METU Department of Chemical Engineering

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