Seminario INTEC – INGAR

Nanoscale Process Systems Engineering: Towards Molecular Factories, Synthetic Cells, and Adaptive Devices

Fecha: Jueves 25 de febrero – 10:00 hs – Duración 1 hr, 30´
Lugar: Auditorio CCT CONICET, Güemes 3450, Santa Fe
Idioma: Inglés

Expositor: George Stephanopoulos, Department of Chemical Engineering
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Abstract: Research in nanoscale science and engineering has been primarily directed towards the design and manufacturing of (a) materials with passive nanostructures, and (b) active devices with nanostructured components. Research on the conceptual design, fabrication and operation of integrated "nanoscale factories" is lagging seriously behind. It is progress at this frontier that will enable the research visions of molecular factories, synthetic cells and adaptive devices to become reality.

This presentation will be composed of two parts: In the first part I will describe the essential systems engineering questions that need to be addressed before we are able to design, fabricate and operate processes at the nanoscale. These questions define my research interests and include: (a) synthesis of "molecular factories" through metabolic networks; (b) fabrication of structures with desired geometries; and (c) design of self-regulating dynamic systems. In the second part I will discuss in more detail our research work in the first two areas: In (a) the discussion will center on the synthesis of four interacting reaction networks, which emulate (i) the raw materials conversion to desired product(s), (ii) energy production and dissipation, (iii) generation and utilization of "information" molecules for monitoring and control, and (iv) generation of molecules for the replication of the molecular factory. In the second area, (b), I will discuss the controlled formation of self-assembled nanostructures with desired non-periodic geometric features, and the design principles and methodologies guiding such a formation: a hybrid top-down formation of physical domains with externally-imposed controls, and bottom-up generation of the desired structure through the guided self-assembly of the nanoscale particles.

Brief Resume: George Stephanopoulos is a Professor of Chemical Engineering at the Massachussets Institute of Technology (since 1984) and one of the most distinguished and influential researchers in the Process Systems Engineering field. He obtained his Diploma in Chemical Engineering at the National Technical University of Athens, Greece, in 1970, his M.E. degree at McMaster University, Canada, in 1971, and his Ph.D. at the Univeristy of Florida, USA, in 1974.

Major and most recent awards include the AIChE Founders Award, 2012; American Academy of Arts and Science Fellow, 2012; one of the "One Hundred Engineers of the Modern Era" by AICHE, 2008; Fellow of AIChE, 2006; "BalwantS. Joshi Distinguished Visiting Professor in Chemical Engineering" UICT, Mumbai, 2005-06; "Gerster"Lecture, Universityof Delaware, 2004; William H. Walker Award, AIChE, 2003; AIChE Institute Lecture, 2003; Honorary Doctor of Science, McMaster University, 2002; "Roger Sargent" Lecture, ImperialCollege, 2000; National Academy of Engineering, 1999.

The current research interests of Prof. Stephanopoulos are in the areas of nanoscale process systems engineering, multiresolution modeling and design of materials and processes, as well as multiscale process operations and control.