SEMINARIOS DEL INTEC
DR. ALBERTO CASSANO
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“Dynamic scheduling of batch operations and customer order transactions in a chemical supply chain and extensions for handling disruptions and multi-echelon inventory optimization”

Fecha: Miércoles 06/07/2022 – 11:00 h

Lugar: Aula 18 – Edificio INTEC I, Predio CCT-CONICET Santa Fe

Expositor: Prof. Dr. Ignacio E. Grossmann

Información resumida del seminario:

There are two main approaches to supply chain modeling: the bottom-up and top-down approaches [1]. The top-down approach is the more traditional approach to supply chain optimization, which focuses on the design, planning, and scheduling of supply chains. On the other hand, the bottom-up approach targets the transactional processes that are present in Enterprise Resource Planning (ERP) systems. In the PSE community, some authors have emphasized the need for a holistic approach to supply chain management, requiring a paradigm shift from operation-based decision support systems to integrated decision frameworks that account for the different areas (e.g., accounting, research and development, sustainability) and flows (material, financial, and information) associated with supply chains [2].

In this talk we address this need by merging the two approaches mentioned by Shapiro. As a first step in accomplishing this, a framework is presented to integrate the material flows in a chemical batch plant with the information flows in the order fulfillment or order-to-cash (OTC, [3]) supply chain process. Previous work includes the development of MILP scheduling models to optimize the order transactions in the OTC process [4]. However, these works focus primarily on the information flows in the supply chain and represent the physical processes as nodes in the transactional process network with a lumped process duration. In this work, we provide a more comprehensive approach, which incorporates manufacturing MILP scheduling models in the OTC process model.

This approach provides a more complete and accurate view of the supply chain by accounting for both material and information flows. The use of chemical production and material availability models enables an accurate modeling of the processing times in the chemical manufacturing steps, which in turn allows the optimization models to find better solutions when scheduling customer orders. Thus, this takes a step forward in the development and management of digital supply chains by coupling information flows captured in the ERP system with material flows in the production processes. An illustrative example is presented in the context of the order fulfillment business process in the make-to-order batch chemical plant presented in [5]. Finally, we first discuss extensions of the proposed models to handle disruptions in supply chains.

We describe a multiperiod MILP model that integrates information from plant production and scheduling, shipping, and order management to generate an optimal response that minimizes the financial impact of supply chain disruptions. We also describe a generalized Multi-Echelon Inventory Optimization (MEIO) model based on the Guaranteed-service approach for allocating safety stocks across the network, seeking to meet customer

service levels at minimum holding costs. The proposed model accounts for several features such as non-normal demand distributions, period between reviews, minimum order quantities (MOQ), and different service level performance indicators. To improve the model efficiency we reformulate the nonlinear programming model as a mixed-integer quadratically constrained model, which leads to order of magnitude reductions in CPU time.

Información breve del expositor:

Ignacio E. Grossmann es “Rudolph R. y Florence Dean University Professor of Chemical Engineering” y ex-Director del Departamento de Ingeniería Química de Carnegie Mellon University. Obtuvo su B.S. en Ingeniería Química en la Universidad Iberoamericana, Ciudad de México, en 1974, y su M.S. y Ph. D. en Ingeniería Química en Imperial College en 1975 y 1977, respectivamente. Luego de trabajar como Ingeniero de I+D en el Instituto Mexicano del Petróleo en 1978, ingresó a Carnegie Mellon en 1979. Es miembro y director del “Center for Advanced Process Decision-making” de esta Universidad, un consorcio industrial que involucra a unas 20 empresas petroleras, químicas, de ingeniería y empresas de software. Es miembro de la Academia Nacional de Ingeniería (EE.UU.) y de otras prestigiosas academias. Ha recibido muy numerosos premios y reconocimientos otorgados por instituciones de Estados Unidos y de diversos países, así como varios doctorados honorarios. En relación a Argentina se destaca el Premio Luis Federico Leloir por sus destacados aportes al desarrollo de la ciencia y la tecnología en Argentina y el Doctorado Honoris Causa de la UNL.

Sus intereses de investigación se encuentran en las áreas de síntesis de procesos, integración energética, flexibilidad de procesos, planificación y programación de procesos “batch” y continuos, optimización de la cadena de suministro, así como optimización mixta-entera y basada en lógica. Ha dirigido más de 60 Tesis de Doctorado y más de 20 de Maestría. Es autor de más de 800 artículos (841 documentos citados en Scopus, índice h=102, 39185 citas), varias monografías sobre estudios de casos de diseño, y los libros de texto “Advanced Optimization in Process Systems Engineering” y “Systematic Methods of Chemical Process Design”, del que fue coautor con Larry Biegler y Art Westerberg. También ha organizado la biblioteca virtual sobre Ingeniería de Sistemas de Procesos.

EL SEMINARIO SERÁ DICTADO EN ESPAÑOL

Duración aproximada: 60 minutos

Referencias

[1] J. Shapiro, 1999, Bottom-up vs. top-down approaches to supply chain modeling, Quantitative Models for Supply Chain Management, 737-759.

[2] J.M. Laínez, L. Puigjaner, 2012, Prospective and perspective review in integrated supply chain modeling for the chemical process industry, Current Opinion in Chemical Engineering, 1, 430-445.

[3] K.L. Croxton, 2003, The order fulfillment process, International Journal of Logistics Management, 14, 19–32.

[4] H.D. Perez, S. Amaran, E. Erisen, J.M. Wassick, I.E. Grossmann, 2021a, Optimizaiton of extended buisness processes in digital supply chains using mathematical programming, Computers and Chemical Engineering, 152, 107323.

[5] E. Kondili, C.C. Pantelides, R.W.H. Sargent, 1993, A general algorithm for short-term scheduling of batch operations-I. MILP formulation, Computers and Chemical Engineering, 17, 211–227.