Systems & Control Transactions

Extended Abstract
Foundations of Computer Aided Process Design (FOCAPD 2024)
Breckenridge, Colorado, USA. July 14-18, 2024
Not Peer Reviewed

PSE PRESS

The Current Status of Process and Product Design – What and How to Teach – and a Vision for the Future

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Keywords: Process Design, Product Design, Education

EXTENDED ABSTRACT

Process design is a core component of chemical engineering education and either involves or is followed by an extensive design project in most schools. The design project is often considered a core activity in the education of future chemical engineers because it develops their skills in creative and critical thinking beyond the boundaries of their acquired knowledge, as well as training them in teamwork. Such skills are likely to be crucial to empower students to develop process technologies that respond to the relevant future challenges in process design. These future challenges include accommodating alternative raw materials and energy resources, addressing sustainability concerns, and arranging production schedules that are more flexible. Some schools already integrate certain of these challenges in process design courses and design projects, e.g., water and energy conservation as well as CO_2 capture, storage and utilization, and biochemical manufacturing. At the same time, process design tools are also evolving, including, for example, increased emphasis on combination with data-based methods, digital twin concepts, or integration with virtual and augmented reality tools.

On the other hand, only a small fraction of chemical engineering departments teach product design. With industrial diversification, it is of growing importance to teach techniques for selecting products that satisfy consumer needs while incorporating the latest new R&D technologies. Our presentation will describe methods for helping undergraduate students learn the technologies sufficiently well to incorporate them in designing new products. Here expert faculty and industrial persons, along with doctoral researchers, can formulate timely product design problems, while helping students obtain solutions. Clearly, new products should be accompanied by process designs, but product-design strategies are emphasized. Also, initially, methods for selecting new products using well-known technologies are emphasized. Furthermore, product-designs that involve AI and account for the environment and sustainability can be considered. Finally, reasons many departments teach only process design are covered. For FOCAPD 2024, an extensive report, prepared by faculty and industrial persons, describing the latest approaches, will be summarized. The report, Teaching Chemical Product Design, will have been circulated worldwide with a survey concerning product design – the results of which will be de-scribed at the conference.

To summarize our combined position, we propose to present the state of the art in teaching process and product design, and to begin a discussion on how to achieve these objectives within the timeframe that is allocated to chemical process/product design instruction.