

Scientific Program Details for Day 2, Tuesday, 18 June 2024

PSE for Synthetic Biology

Chaired by Prof. Christopher Rao, U. of Illinois, Champaign-Urbana

Session Synopsis:

This session will explore research challenges and opportunities at the interface of PSE and synthetic biology. A key focus will be on the application of feedback control and AI/ML to genetic engineering and biosystems design and operation. The session will also cover emerging topics in biomanufacturing, systems biology, and biochemical/fermentation engineering, with a particular emphasis on AI/ML

First Invited Talk

Challenges and opportunities in feedback control of living cells

Prof. Mustafa Khammash, ETH Zurich

Abstract

This presentation explores the evolving landscape of feedback control in living cells, an interdisciplinary field at the intersection of biology, engineering, and computational sciences. I will discuss the unique challenges inherent in manipulating biological systems at the molecular scale, such as their inherent complexity, variability, and noisy dynamics. I will then discuss fundamental design strategies that are suited for biomolecular controller implementation. The resulting controllers offer unprecedented control over cellular processes, thus unlocking significant opportunities in therapeutic applications, synthetic biology, and industrial biotechnology. This advancement underscores the potential of feedback control in revolutionizing cell-based technologies and personalized medicine.

Second Invited Talk

Systems Biology Challenges for Control of Human Diseases

Ashlee N. Ford Versypt, University at Buffalo

Abstract

Chemical, physical, and biological processes interact across multiple scales and have consequences for physiology, disease progression, and treatments. "Systems biomedicine" seeks to bridge the gap between molecular and cellular systems biology and clinical medicine by acquiring and integrating many diverse data sets across scales and interacting physiological systems to design and control responses to therapeutics. We will discuss some challenges in areas of manual curation and physics-based model building, natural language processing for searching and integrating volumes of data from prior animal and clinical studies, data science techniques to facilitate design of experiments, and quantitative systems pharmacology for drug treatments.

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