



Centre for Biosystems Science and Engineering

SEMINAR

at 4:00 PM on July 21, 2017

BSSE meeting room, 3rd floor Biological sciences building

Engineering Desired Behaviors in Populations of Living Cells

Prof. Calin Belta

Mechanical engineering, Boston University

Recent developments in nanotechnology and synthetic biology have enabled a new direction in biological engineering: synthesis of collective behaviors and spatio-temporal patterns in multi-cellular bacterial and mammalian systems. This will have a dramatic impact in such areas as amorphous computing, nano-fabrication, and, in particular, tissue engineering, where patterns can be used to differentiate stem cells into tissues and organs. While recent technologies such as tissue and organoid on-a-chip have the potential to produce a paradigm shift in tissue engineering and drug development, the synthesis of user-specified, emergent behaviors in cell populations is a key step to unlock this potential and remains a challenging, unsolved problem. In this talk, I will start with an overview of an ongoing project in which we bring together synthetic biology and micron-scale mobile robotics to define the basis of a next-generation cyber-physical system (CPS) called biological CPS (bioCPS). I will then focus on a novel approach to machine learning, which is central to this project. I will introduce temporal logic classifiers for timed data and spatial logic classifiers for images. I will then show how they can be combined into spatial temporal classifiers. I will also discuss verification and synthesis techniques.

About the speaker:

Calin Belta is a Professor in the Department of Mechanical Engineering at Boston University, where he holds the Tegan Family Distinguished Faculty Fellowship. He is the Director of the BU Robotics Lab, and is also affiliated with the Department of Electrical and Computer Engineering and the Division of Systems Engineering at Boston University. His research focuses on dynamics and control theory, with particular emphasis on hybrid and cyber-physical systems, formal synthesis and verification, and robotics. He received the Air Force Office of Scientific Research Young Investigator Award and the National Science Foundation CAREER Award. He is an IEEE Fellow.