# AIChE *Webinar Series*

*Computing & Systems Technology Division (CAST) Welcomes*


## *Zuyi (Jacky) Huang*

Assistant Professor
Department of Chemical Engineering


## *Inverted-classroom Approaches to Educate Undergraduate and High-school Students with MATLAB in Process Control and Modeling*

The inverted-classroom teaching format and the application of MATLAB/Simulink have recently generated considerable research interest in chemical engineering education. MATLAB/Simulink was introduced in mathematics-intensive courses due to its user-friendly interface for mathematical model simulations. Inverted classroom approach has been reported to be generally beneficial for engineering courses, but it has not been applied to MATLAB/Simulink education in a single course. The aim of the first project in this work is to examine the effectiveness of the inverted-classroom approach in developing MATLAB/Simulink skills of upper-division undergraduates in Villanova's chemical process control course. Teaching modules include solving ODE models, performing Laplace transform, and designing PID controllers. Surveys of students' evaluation revealed that the three inverted-classroom teaching modules were effective in enhancing students' understanding of mathematics-intensive process control concepts and improving their MATLAB simulation skills. Students' overall feedback on the inverted-classroom format was positive as they gradually adapted to inverted-classroom learning format.

USA high-school students are falling behind their peers from other countries such as Finland and Korea in their mathematical performance. Solving ordinary differential equations (ODEs) is especially challenging to USA high-school and college students. It is thus necessary to re-generate the momentum of inspiring or stimulating high-school students to participate in more math-related trainings or projects. In the second project of this work, we developed a web-based training approach to train high-school students modeling skills to simulate the dynamics of microbial fuel cells (MFCs) in MATLAB Simulink. Due to its capability of digesting organic compounds from waste water to generate electricity, the MFC is regarded as one of the most sustainable approaches to treat waste water and generate bioenergy at the same time. MATLAB Simulink makes solving ODE models as interesting as building Lego projects. Two junior students from local high-schools watched the training videos and built the MFC ODE model in MATLAB Simulink with the help from the instructor via chat software Skype and

Teamviewer. A survey was given at the end of the project to evaluate the improvement students' knowledge in MFC and gather what students like and dislike the pseudo inverted-classroom approach. The result shows that it is promising to attract and train high school students with modeling skills by providing web-based training modules and Skype meetings.

**Biography:**

Zuyi (Jacky) Huang received his Ph.D. at Texas A&M University in 2010. He is now an Assistant Professor in the Department of Chemical Engineering at Villanova University. He teaches Chemical Process Control (for senior students) and Systems Biology (for graduate students). He is enthusiastic in applying innovative teaching methods in class to educate students with modeling and control skills. He and his colleagues at Villanova got 2016 ASEE Joseph J. Martin Award. He is the director of the Biological & Environmental Systems Engineering Lab (BESEL). His research is focused on developing advanced modeling and systems analysis techniques to manipulate microbial biological systems for generating biofuels from wastewater and for combating biofilm-associated pathogens.

**Join Webinar on May 9, 2017 at 10 AM Eastern Standard Time (EST) at http://goo.gl/5ySqO4**