TEACHING STATEMENT

Truong Xuan Nghiem

Summary of Experience

At EPFL, I am currently co-supervising a master student's project on modeling and control of the EPFL's solar-powered house, which will participate in the 2017 Solar Decathlon competition in the United States. During my graduate study at Penn, I was a teaching assistant for two graduate-level courses: *Linear Systems Theory* in electrical engineering (ESE-500) and *Principles of Embedded Computation* in computer science (CIS-540). As the latter was one of the first courses on real-time embedded systems offered at Penn and its syllabus was still being prepared at the time, I assisted the professor to develop the course materials on control theory and real-time control systems. I also helped organize a special topics course in 2011 on energy-efficient buildings (CIS-800), which involved reviewing the literature, scheduling talks and guest speakers, managing the course website, and giving three lectures. In Fall 2013 and Spring 2014, I gave substitute lectures on real-time embedded control systems in the graduate-level course *Real-time Embedded Systems* (ESE-519) and the undergraduate-level course *Micro-controllers & Embedded Systems* (ESE-350), and mentored a student project on hardware-in-the-loop adaptive cruise control emulation. Prior to my PhD study at Penn, I had been a lecturer at the Hanoi University of Technology (Vietnam) for two years, where I taught a control theory course and co-supervised two undergraduate final projects.

Teaching Philosophy

I believe that, in order to prepare students for engineering careers, a successful engineering and applied science education must: 1) motivate and guide students to learn the fundamental knowledge and get a big picture of their fields; 2) provide students with practical training and hands-on experience; and 3) develop critical thinking and communication skills in students.

There is no doubt that for any field, its fundamental principles are of great importance. However, without motivations and proper guidance, they can be rather boring and difficult to learn and understand. In my experience, the most effective motivations are examples, whether simple or complex. When I gave my substitute lectures on real-time control systems in the embedded systems courses at Penn, where most students had not taken any control courses before, I used interactive Matlab & Simulink simulations throughout the lectures to illustrate the basic concepts and make the theory more interesting and easier to understand. I have observed that interactive lectures and live demonstrations are powerful and intuitive tools to engage students and help them grasp theoretical concepts. I also find it important to transfer a big picture of the course materials to the students by showing a road map at the beginning of the course and of each class, which will help the students visualize what will be learned and how they fit together. The road map will also guide them in learning and assessing their understanding of the materials.

A student in engineering and applied science needs to have a solid theoretical foundation as well as practical knowledge. The latter is complementary to the first and helps reinforce the foundational knowledge of a student. In addition to homework exercises and tests, I encourage and help students gain practical training and hands-on experience through lab experiments and projects. During my teaching of control theory at the Hanoi University of Technology, I developed control system simulators and a series of lab experiments, in which students were tasked to analyze and design controllers for these systems. The practical knowledge and experience gained from these exercises helped motivate the students and strengthen their fundamental knowledge.

Finally, critical thinking and communication are among the most important skills of any engineer or scientist. When explaining or solving problems in class, I focus more on the thought process: how I analyze and approach the problems to solve them. Group and individual projects are also excellent opportunities for students to learn and improve their critical thinking and problem solving skills. I spend time to help students choose appropriate project ideas and provide general guidance, but let them think and decide how to approach the projects and implement them. Project reports and presentations are important to teach students the necessary skill of communicating technical ideas and results effectively. I also plan to experiment with requiring a short pitch at the beginning of each project presentation, a skill I have found very valuable in practice.

In **graduate teaching**, I will adapt the teaching method to include rigor and exposition in my lectures. While doing so, I can keep my students motivated and my lectures enjoyable by, for example, citing historical facts about the subject and introducing emerging applications and open problems.

Course Development

I am looking forward to offering introductory and advanced courses in *systems & control theory* and *convex optimization*, at both undergraduate and graduate levels. I am also interested in developing new courses in two areas. The first is a specialized course, at the graduate or senior undergraduate level, that covers optimization-based control theory, in particular model predictive control. This is a highly active area with recent cutting-edge developments, which is increasingly applicable and useful in practical applications. The other area includes special and emerging topics in cyber-physical systems and control, for example smart buildings, smart grids, and machine learning based control. These topics are appropriate for advanced seminar or research courses at the graduate level.

In my courses, the interdisciplinary nature of my research will enable me to bring new perspectives and real-world problems across multiple engineering domains to the curricula and to my teaching.