TEACHING STATEMENT

"Give a man a fish and you feed him for a day. Teach a man to fish and you feed him all the way."

— An old Chinese proverb

Educational Philosophy

Increasing complexity and diversity of large-scale engineering systems call for engineers with new types of competencies: (i) ability to work collaboratively in a global distributed environment, and (ii) system-thinking abilities. It is therefore my intention that engineering education should help students in building scientific foundations for future complex systems development. I believe such a change will shift engineers' thinking from a discipline-specific to a broader systems engineering view.

My educational philosophy is centered on the psychological concept of *motivation*. According to the expectancy-value theory of motivation[1], individual motivation for a task depends on perceptions about the odds of success on the task and the value of completing the task. In learning, the students' expectancy briefs and subjective task values directly influence their performance in the class. Therefore, to motivate students to learn, the role of instructor is crucial. The old Chinese proverb mentioned above inspires me to go beyond an instructor whose role is to deliver knowledge. In this true spirit, my instructional role is to become a coach. The role of a faculty as a coach is to create an environment for active learning rather than passive one-way flow of information. Specifically, the faculty architects the course content and provides the necessary scaffolding to motivate students to learn by (i) increasing students' perceived probability of success in a class, and (ii) increasing students' perceived value from the expected outcomes. In practice, detailed techniques, such as the open course structure, IT-enabled instruction, presentation style, self-engaged evaluation etc., can be adopted contextually. In my teaching, I undertook few modest steps in this direction. In the next section, I describe some of my experiences in detail.

Teaching Experience

As a Ph.D. student, I enjoyed the privilege of participating in teaching and mentoring activities, including teaching workshops, teaching assistant and lab instructor for an upper-level undergraduate course, and guest lecturer for a graduate level course. As a senior member in the Design Engineering Lab, I also had opportunities to mentor junior graduate students. These experiences are elaborated in what follows.

Teaching assistant and lab instructor: As a teaching assistant and lab instructor for ME475 (Automatic Control Systems), I held office hours, developed lab quizzes, graded homework assignments and exams, suggested and designed final projects. In the regular activities of a teaching assistant, I quickly understood there was something missing to motivate the students. So, I tried to infuse motivation-centric philosophy through incentive mechanisms. For instance, while designing a competition for enhancing the students' ability in solving practical problems, the requirements were set intentionally by extending a course project they had done before, thus the students do not find it difficult. This increases the students' expectancy. Additionally, I increased students' subjective task value through bonus points based on performance. With this performance-based mechanism inspired by the expectancy-value theory, I received very positive feedback. Out of 15 groups (4 in each group), 11 groups fulfilled the tasks. An interesting and substantial output was that the groups outperformed in their projects.

Guest lecture: The main mission of a university is to pursue research and educate students. I advocate to integrate both in a class. In my Ph.D. study, I had an opportunity of implementing this integration through an invited guest lectureship in ME 597 (Decision Making in Engineering Systems Design). In this class, I aimed

[1] J. S. Eccles and A. Wigfield, Motivational Belief, Values, and Goals, *Annual Review of Psychology*, 53, 2002, pp. 109 - 132

to foster the students' system thinking. I used probability theory and utility theory to derive the discrete choice model, and showed its applications in systems design problems. To motivate students to learn, when presenting basic concepts and theories, I stimulated students' enthusiasm (i.e., intrinsic motivation) for engineering by introducing relevant engineering applications. I also encouraged the students to make discoveries by themselves through an illustrating-then-practicing teaching mode. For example, I illustrated how a model can be derived under certain assumptions. Then, I asked the students to derive the second model with different assumptions by following the same framework. In this process, the students was able to have deeper memory on what I had taught, and especially for those aspects where they made mistakes. With the belief of being a coach, an open and enjoyable learning environment was established in the classroom in which a friendly relationship was developed to facilitate bilateral flow of information, e.g., the knowledge feed-forwarded to students and valuable feedback from students. With these teaching techniques, I observed that students concentrated more on the course content, and their focus had shifted from *what-I-earn* to *what-I-learn* which frees them to think critically while learning.

Teaching Interests

Based on my experience in both teaching and research, I believe that I can teach a wide range of courses currently offered in the Department of Mechanical Engineering (ME). I have developed a strong background in the areas of design and control. Hence my interests are oriented towards topics like mechanics, dynamics & control, system engineering, engineering design, etc. In the table below, I list the courses that I feel competent and enthusiastic to teach.

Undergraduate-level Courses	**Graduate-level Courses**
MEEG 2703: Computer Methods	MEEG 4003: Intermediate Dynamics
MEEG 2013: Dynamics	MEEG 4213: Control of Mechanical Systems
MEEG 3113: Machine Dynamics & Control	MEEG 4703: Mathematical Methods in Engineering
MEEG 4104: Machine Element Design	MEEG 5143: Advanced Machine Design

I am also willing to leverage my research to customize the current curriculum at ME I envision to integrate systems engineering education and training into discipline-specific engineering curriculum. To initiate this, I feel confident to introduce an advanced-level course focusing on the particular area of system science with my expertise in both complex system engineering and statistics. A brief introduction of this course is shown as below.

Course Title: "Decision-making in System Engineering and Design"

Course Objective: The target audience of this course is M.S. or Ph.D. students with interdisciplinary research background. The objective is to familiarize students with the underlying theories in decision-making (e.g., the Bayesian decision-making, game-theory, utility theory, etc.) that support the fundamental research in complex system engineering and design.

Course Content: The course will be enriched with state-of-art development in two areas: 1) decision making studies on complex systems, and 2) statistical analysis in engineering design. For example, intermediate statistics (e.g., generalized linear regression, analysis of variance, statistical inference methods including likelihood estimation and testing, and the Bayesian approach) will be taught to empower the students to use appropriate models and/or tools to solve the engineering design problems. The discussed methods will be illustrated through examples involving problems in engineering design of complex systems, such as the complex network analysis, design preference elicitation, design with multi-attributes, etc. The class project will give participants the techniques and insights to tackle the problems related to their own research on large scale system engineering and design, and to provide them with hands-on experience on doing statistical analysis of real-world network datasets.