Statement of Teaching

Interests, Activities and Philosophy

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Teaching a course serves the dual purposes of giving students the technical literacy necessary to contribute in industry while at the same time providing the preparation necessary to be successful in research. Thus the goal of teaching should be to introduce the student to established engineering concepts and practice as well as to prepare the student for solving problems not covered explicitly in the course material. While this approach applies equally well to graduate and undergraduate students, the application of these principles will differ.

Teaching Style, Undergraduate At the undergraduate level, students are presented with a relatively small number of clearly stated challenges. Throughout the course, the principles and methods developed are put into the context of these discrete challenges. At the end of the course, the students are evaluated on their ability to solve these challenges and apply principles to solve minor variations. This methodology allows the student to associate the principle with the problem and thus help organize the information learned in class. In addition, this motivates what may otherwise seem an abstract discussion. Finally, this approach allows me to effectively teach both good and bad students: The worst students will only retain the methodology, while the best students will understand the principles and be able to solve variations on the original problem statement.

Whenever possible, I use well-illustrated slides to present material. This assists the student in visualization of abstract topics and also frees my time for open discussion of the topics and issues. During these discussions, I often ask unstructured questions, such as : "What is the best shape for a satellite?" or "What is the purpose of the vertical stabilizer on this aircraft". This engages the students attention and places the rest of the material in the context of answering the question. For my "Spacecraft and Aircraft Dynamics" class, I created an original set of lecture notes containing over 26 lecture with 700 LaTeX slides and over 500 illustrations. I am currently working on a similar set of lecture notes for my undergraduate class "Systems Analysis and Control".

Teaching Style, Graduate My graduate teaching is structured similarly to undergraduate teaching. However, at the graduate level, I expect students to be able to consistently apply the learned principles to solve major variations on the core problem statements. I also require my graduate students in certain classes to be mathematically rigorous. This includes teaching proof techniques and assigning proofs in homework and exams. Exams are typically take-home. I still teach many graduate lectures using slides. However, when I present proofs, these are often done by hand in order to illustrate the train of thought. Students are asked for suggestions on how the proof may proceed. For classes on optimization or other algorithm-intensive classes, students have weekly programming assignments.

Graduate Student Mentorship When preparing graduate students for independent research, it is critical to establish early on the habit of rigorous thought. In my own experience, this is best accomplished through exacting attention to accuracy and precision in both spoken and written word. I require students to prepare presentations on selected topics for both lab meetings and then for the departmental Dynamics and Controls Colloquium which I have initiated with B. Pervan and M. Spenko. This initial grooming of the student is necessarily at the expense of research. However, after the student has become habituated to rigor in thought, then more attention is paid to progression of research. The justification is that the research thus produced will be of higher quality and require less in the way of supervision. Note that such an approach requires a sufficiently dedicated and engaged student. I have only been able to obtain 2 such students through a substantial process of attrition. Finally, after substantial progress has been made in research, I emphasize engagement of the student with peers in the academic community through conferences and working visits.

Experience I have taught 3 graduate and 6 undergraduate classes at IIT over the past 3 years. During this time, I have had high undergraduate student satisfaction (4.2/5) in courses which use LaTeX slides. At IIT, I have supervised 7 students, of which I chose to retain 2 exceptional PhD students and 1 masters student. Prior to joining IIT, I had tutored incoming graduate students in preparation for the Aerospace Engineering PhD oral qualifying examinations at Stanford University. During my last two years at Stanford, I helped to supervise new students in the Network Systems and Controls lab. At INRIA, I have worked with 3 PhD students. I have also tutored undergraduate mathematics and also algebra and geometry for elementary school students.

Course Topics I would welcome the opportunity to teach a broad diversity of classes. Some examples of undergraduate classes which I would be able to teach immediately include *Control Systems* [Slides], *Orbital Mechanics* [Slides], and *Flight Dynamics* [Slides]. Examples of graduate-level classes include *Linear Systems* [Slides], *Robust Control* and *Optimal Control* [Slides]. Additional courses I would like to teach include "Nonlinear Systems" and "Control of PDE Systems".