TEACHING INTERESTS

OVERVIEW

I have been teaching at the University of Florida since I joined the faculty in 1999. Within the department of Mechanical & Aerospace Engineering, I have taught undergraduate and graduate courses in multibody dynamics, numerical methods, and musculoskeletal modeling. I have developed all of these courses from scratch after a thorough review of available textbooks and related instructional software.

Wherever possible, I try to incorporate modeling, simulation and computation software into my courses, as computational skills are becoming increasingly important in engineering practice and research. In my undergraduate and graduate dynamics courses, I have students complete a course project where they derive dynamics equations and simulate a dynamic system using Autolev symbol manipulation software (now called Motion Genesis, http://www.motiongenesis.com). In my undergraduate and graduate numerical methods courses, my students use Matlab software (http://www.mathworks.com) for learning structured programming concepts, developing and implementing different numerical methods, and completing a course project that requires combining multiple numerical methods to solve a real-life problem. In my undergraduate and graduate musculoskeletal modeling courses, I have students use the freely available OpenSim musculoskeletal modeling software (https://simtk.org/home/opensim) for simulation laboratory assignments and a course project. For the project, they model the human lower body and use experimental data to simulate how muscles coordinate a soccer kicking motion or how muscles contribute to knee contact forces during walking. In each case, the use of software forces students to figure out how to apply what they have learned to a complex problem where the solution process is not pre-defined and creative and independent thinking are required.

IMPACT

I greatly enjoy my interactions with students in and out of the classroom, and I take great pride in helping students learn and internalize the material I teach. I have received a Teacher of the Year Award twice – from my department in 2000-2001 and from the University of Florida College of Engineering (approximately 300 tenure-track and non-tenure-track instructors) in 2007-2008. In 2011-2012, I was one of 10 professors nominated for the "Last Lecture” Lecturer of the Year Award, and I was also selected that year as an Anderson Scholar Faculty Honoree for being a “faculty member who has been particularly inspiring or influential.” To date, my average teaching evaluation is 4.6 out of 5.0 for undergraduate courses (many above 100 students) and 4.7 out of 5.0 for graduate courses. I have formulated a written teaching philosophy that describes the principles I follow when teaching. This statement can be found on my laboratory website: http://www2.mae.ufl.edu/~fregly/PDFs/teaching_philosophy.pdf.

One of the challenges of teaching at a large public university has been finding ways to connect with students in large (sometimes greater than 200 students) courses. To address this challenge, I came up with the idea of "personal hours," which are like office hours except students cannot ask me anything about the course I am teaching. I hold personal hours at the student union during lunch several times each semester. I tell students that during personal hours, they are free to ask me any question they like, whether it be about graduate school, working in industry, research, or personal topics such as work-family balance. I typically have between one and ten students show up for personal hours, and the conversion is usually quite lively. Students have greatly appreciated having these informal opportunities for me to get to know them better as well as for them to get to know me better.

Over the past few years, I have observed that students who come to personal hours are often the ones who do the best in my courses and who seek out undergraduate research opportunities. This observation is consistent with a recent Chronicle of Higher Education article entitled “The Power of the Personal” by Daniel F. Chambliss (http://chronicle.com/article/The-Power-of-the-Personal/148743/). In that article, Dr. Chambliss comments that, "It’s not that formal programs, facilities, and funding don’t matter; they do. But at its heart, higher education is a human activity, powered primarily by bringing thinkers together. So rather than attending so much to programs and policies, maybe higher education should focus first on its people, and on helping them find—and eventually care about—one another." To support his position, he notes that, “The 2014 Gallup-Purdue Index found that having ‘a mentor who encouraged my hopes and dreams,’ ‘professors who cared about me,’ and ‘at least one professor who made me excited about learning’ made students far more likely to be successful later in life.” I welcome the challenge of...
connecting with students on a personal level and am pleased that I have been able to do so with a number of students from my courses.

Of course, one of my greatest and most important opportunities for teaching impact is on the undergraduate and graduate students performing research in my lab. I view my responsibility to my research students as going beyond what I teach them about research. I have helped each of my undergraduate research students navigate the graduate school application process and find positions at other universities (as much as I would like to keep them). For my graduate students, I have assisted each of them with finding positions in academia or industry, depending on their interests. My graduate students have been recruited by Dr. Scott Delp at Stanford University, Dr. Marcus Pandy at the University of Melbourne in Australia, Dr. Fran Sheehan at the National Institutes of Health, and Dr. Wafa Skalli at the Ecole Nationale Supérieure d’Arts et Métiers in Paris, as well as by Samsung Electronics, Johnson & Johnson, Materials Sciences Corporation, Solidworks Corporation, RTI Surgical, and Biomet. One of my former PhD students is now an assistant professor at the University of Tennessee, and my recent post-doctoral fellow just started her first faculty position at the University of Dayton.

COURSES

In general, I am interested in teaching courses related to dynamics, numerical methods, and my research area of neuromusculoskeletal modeling. As noted above, I am particularly interested in integrating software into the classroom to increase student involvement in the learning process. Below is a list of courses that I have taught at the University of Florida and would be interested in continuing to teach in the future. I would also be interested in developing a new undergraduate and/or graduate course on rehabilitation engineering, where clinical collaborators provide real-life rehabilitation problems involving stroke, Parkinson’s disease, cerebral palsy, or lower limb amputation that serve as the basis for problem-based learning simulation projects.

Undergraduate


Biodynamics – Application of rigid multi-body dynamics concepts to the human musculoskeletal system and basic musculoskeletal simulation methods. Textbook: None (extensive typeset lecture notes distributed to students). Software: OpenSim musculoskeletal modeling/simulation.

Graduate

Analytical Dynamics – Derivation of kinematic and dynamic equations for three-dimensional multi-body systems using Newton-Euler, D’Alembert, Lagrange, and Kane methods, along with modeling and simulation of these systems. Textbook: Advanced Dynamics for Mechanical, Aerospace, and Biomechanical Engineers by Mitiguy. Software: MotionGenesis symbol manipulation.


Future

Rehabilitation Engineering – Development of neuromusculoskeletal simulations to design improved rehabilitation treatments for movement-related disorders such as stroke, Parkinson’s disease, knee osteoarthritis, cerebral palsy, and lower leg amputation. Textbook: Selected journal articles. Software: OpenSim musculoskeletal modeling/simulation and Matlab. For the undergraduate version, all
students would perform a course project related to a single well-defined clinical problem. For the graduate version, several clinical “sponsors” would visit the class to provide an overview of a clinical problem where personalized neuromusculoskeletal simulations could potentially improve treatment. Students would choose the clinical problem of greatest interest and would work in teams of two to simulate the outcome of one possible treatment approach.