Developing a Numerical Methods Course with a Substantial Computer-Programming Component Based on Cutting-Edge Research Problems: Success and Challenges

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Abstract

In order to meet the growing needs of both industry and graduate schools, where BME students are expected to know programming in higher level mathematical languages and have familiarity with numerical methods, we developed an integrated lab course that focuses simultaneously on languages, algorithms, and numerical methods. Given that our students come with a diverse background in mathematics and programming, our course has two fundamental goals. Firstly, we introduce two high-level computer programming languages suitable for math-intensive engineering studies, i.e., Matlab and Mathematica, in an effort to develop critical thinking and ensuring that students are able to work through complex problems without getting lost in syntax and programming style. The second focus of the course is to use these languages to construct and analyze computationally intensive problems tackled by BME researchers for cutting-edge research. To achieve this goal, all of our modules and homeworks are based on research problems currently of BME faculty in our department. This approach not only gets students excited about programming and proficient, it also proves beneficial to the faculty in getting fresh ideas about their current problems. Our presentation will highlight the results of monthly student surveys and end-of-term analysis along with challenges in teaching such an integrated course to students with little or no formal training in linear algebra and numerical methods.