TAM CORNELL - DEFINING AND UNIFYING FEATURES

The fundamental questions that organize and motivate research and teaching in the department of Theoretical and Applied Mechanics at Cornell are: 1.) What is the simplest mathematical description of a phenomenon that captures its essence? 2.) What analytical and computational techniques must be applied and developed in order to make specific predictions based on such a mathematical description? and 3.) What experiments should be carried out to test such predictions or to provoke the development of a mathematical description of a phenomenon?

As indicated above, the common links between the modeling and the experiments are analysis and computation. Consequently, it is not surprising that the basis for intellectual discourse between and among the faculty and students of TAM is a shared culture in classical physics, applied mathematics and, increasingly, computational science.

The faculty and graduate students develop this common culture when they collaborate in the teaching of courses in calculus, engineering mathematics, and fundamental mechanics to undergraduates. When integrated over the years, faculty typically have co-taught courses with more than two-thirds of their departmental colleagues. The common culture is reinforced in the department's offering of graduate courses in applied mathematics and in the mathematical content and style of the undergraduate and graduate courses given in the department's principal concentrations in dynamics and solid mechanics. The language of applied differential equations is used by faculty and students, by experimenters and theorists, and by researchers in dynamics and solid mechanics in every aspect of the department's function. Finally, faculty and graduate students attend weekly departmental seminars that bring them into contact with research across the entire field.

Our emphasis in TAM on simple, essential models of distinct phenomena distinguishes us from our colleagues in the professional engineering departments, who must incorporate into their descriptions the multiple, detailed phenomena of specific systems. Also, because we consider simpler systems, our goal can be understanding and insight into fundamental mechanisms while theirs must be the faithful description of complicated systems, with the goal of constructing functioning engineering structures, processes, and devices. In our activities, we inevitably operate on the boundary of engineering science and, in doing so, provide the college with a link between pure science and practical engineering. Finally, because our focus is on the essential, our methods can be general, and our results are often applicable to similar phenomena in widely different fields. Because of this, we have a strong tradition of collaboration across department and college boundaries. Research in TAM is widely cited - for example, six of the thirteen faculty in TAM have citation indices greater than twenty-five, and the median TAM faculty member has about the same citation index as the median Cornell National Academy of Engineering faculty member.

In the years between the end of the Second World War and the end of the Apollo Program, American universities, and especially their engineering colleges, expanded, and many departments of mechanics and engineering science were created. These departments were leaders in moving engineering from a practice-oriented discipline to one founded on scientific principles. However, as the faculty in the traditional engineering fields became adept at research based on mathematics and physics, engineering science departments became less necessary – they had succeeded in helping to create the modern engineering research college. TAM persists at Cornell because its faculty continues to carry out cutting-edge research in non-traditional engineering fields and because of its unique role in the teaching of engineering mathematics.