

# **Terman Award Acceptance Speech**

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I am most grateful and honored to receive the 2005 Frederick E. Terman Award. I am also pleased to receive the award in Indiana the birthplace of Professor Terman in whose honor this award is dedicated.

I am most grateful to the Terman Award Selection committee, to my nominator, Professor Sanjit Mitra of the University of California Santa Barbara, to the students and colleagues who supported the nomination, to the Electrical Engineering Department at UCLA for a supporting environment, and to the Hewlett-Packard Company for sponsoring this award. I am also thankful to my publisher at Wiley for helping me produce a quality textbook on the subject of adaptive filters.

As you already know, the Terman Award is meant to recognize an educator's achievements in teaching and research, and the publication of an electrical engineering textbook of outstanding quality. Those of you who are familiar with Terman's biography will recognize that these were some of the traits that Terman exhibited during his impressive career. It is therefore most humbling for me to join a long list of distinguished Terman Award recipients and to be considered for an award that celebrates Terman's example and influence.

Terman was a man of vision who helped shape the electronics industry into what it is today. His grasp of the role that academia can play in shaping industry and society was both brilliant and prophetic. A close look at where the field of

electrical engineering stands today helps illustrate the potential that started decades ago and the potential that still lies ahead of us.

We live today at the dawn of a new millennium with great promises of scientific discoveries that will influence our lives in fundamental ways. The world itself is shrinking and becoming a highly connected place. This advance is happening in response to amazing progress in many areas including electronics, wireless communications, satellite television, and the Internet. Only a decade or two ago, much of what we take for granted today, such as cell phones, satellite TV, and the Internet, were not part of our everyday lives. Today, communities and nations are sharing information and learning about each other at paces not imagined before. Information is literally traveling around the globe at the speed of light. Science and progress are bringing societies closer to each other.

Paraphrasing man's first words on the surface of the moon, this progress is a small step for man and giant leaps still await mankind. We are embarking on exploring new directions with immense challenges and promise. Examples include building tiny machines that can manipulate chemical and biological processes at the molecular level, developing smart materials and devices, designing sophisticated wearable machines, and investigating bio-technology applications.

The electrical engineering field will be playing a major role in defining these new directions. The field itself is at a significant crossroad. Interactions among its traditional disciplines, information technology, physical sciences, and biology are becoming stronger. These interactions are leading to important trends that are helping define and reshape the future of electrical engineering. Three trends are becoming evident, and they elevate the complexity of sensing, analysis, and processing of information to new levels:

- First, the rate at which information needs to be communicated is increasing steadily to rates not imagined before. Vast volumes of information need to be processed and communicated reliably and quickly.
- Second, the scales at which the operations of sensing and information processing need to be performed are shrinking. Sensor and actuator dimensions are becoming smaller in response to advances in micro-, bio-, and nanotechnologies, from the convergence of electronics and biology, and from linking the virtual world to the physical world. New application frontiers are being explored, for example, in biological and environmental sciences, with substantial economic, scientific, and social impacts.
- Third, the complexity of the systems under study is increasing. Complex systems are shifting the emphasis from the study of stand-alone systems to the study of complex intertwined systems. Modeling, which has always been at the core of electrical engineering, is again playing a prominent role. Modeling is helping researchers understand large-scale systems as well as complex physical and biological phenomena. Modeling is also helping establish deeper ties between electrical engineering and physical, mathematical, and computational sciences.

The three trends of volume of information, smaller scales, and complexity of systems are demanding a stronger emphasis on multi-disciplinary work. Today, and perhaps more than ever before, activities in adjacent engineering departments are having an immediate impact on research in electrical engineering. In this environment, and in order to promote and maintain a strong research program, it may no longer be sufficient to have strong faculty. Strong collaborations among the faculty and across disciplines should be encouraged and pursued. Such multi-disciplinary collaborations will reshape academia and industry in years to come. They will also demand a more flexible education structure; one that allows an effective preparation of graduate students for multi-disciplinary work.

In closing, the electrical engineering field is contributing to exciting new directions and is establishing strong ties with adjacent fields. In line with Terman's vision, these interactions will have far reaching consequences on society and everyday life, and on engineering education and the electrical engineering field itself.

I thank you again for this distinction and I wish your organization all the best in years to come.

Thank you all.