In August, 1985, I received my dual bachelor's degrees in Computer Science and Electrical Engineering from Shanghai Jiao-Tong University where I was one of the eighteen honored students of my year. I then came to the University of Southern California. As a graduate student of computer science, I solved several open questions in parallel algorithms and cryptography, and was selected as the "Student of Outstanding Academic Achievement" upon graduation. In 1988, I was admitted to the Ph.D. program in Computer Science at Carnegie Mellon University. There, I became interested in Computational Geometry, Scientific Computing and Optimization. In the summer of 1991, I completed a well-recognized Ph.D. thesis: "Points, Spheres, and Separators: A Unified Geometric Approach to Graph Partitioning." In it, I developed the first linear-time algorithm for partitioning several important families of three-dimensional graphs, such as the nearest neighborhood graphs and finite-element meshes. I also gave the first randomized O(log n) time parallel algorithm for the construction of the nearest neighborhood graphs in any fixed dimension.

I then obtained a much sought after postdoctoral position at Xerox Palo Research Center (PARC) in the fall of 1991. It was at PARC where I began to enjoy active participation in industry and collaboration with engineers and scientists in developing real-world products. This experience brought me to greatly appreciate the value of interaction between theory and practice. I have been pursuing similar academic-industry collaborations ever since, as an instructor of Mathematics at MIT from 1992-1994 (with Xerox and NASA Ames Research Center in developing scientific simulation software), as an Assistant Professor of Computer Science at the University of Minnesota from 1994-1997 (with Intel in building transistor-level circuit validation and simulation software), as an Associate Professor at the University of Illinois at Urbana-Champaign from 1997-2001 (with IBM on web-crawling and information organization), and as a Full Professor at Boston University (with Akamai Technologies on Internet content delivery and Microsoft on spam detection).

The academic-industry collaboration not only makes it possible for theorists and applied mathematicians like myself to have a direct impact on practice, but it has also helped me to initiate new theoretical research. During the course of these collaborations, I received eight United States Patents for my work on compiler and internet technologies. These collaborations underscored the importance and difficulty of interdisciplinary research. Perhaps of equal importance, these experiences helped my educational innovation at universities in designing several new interdisciplinary courses to encourage students to think beyond the traditional scope of a particular discipline. These experiences also helped me and my colleague Alan Edelman in developing a successful summer professional course on parallel scientific computing at MIT in 1995.

During the last decade, my work has been focused on challenging and fundamental problems at the intersection of Theoretical Computer Science, Game Theory, Scientific Computing, Optimization, Computational Geometry, and Parallel Processing. I have obtained several significant and breakthrough results in these areas, which I now summarize:

- With Dan Spielman, I developed the theory of Smoothed Analysis for modeling and analyzing practical algorithms, and demonstrated that the simplex method for linear programming has a polynomial smoothed complexity. Our joint work was cited by the National Science Foundation in its FY'03 budget request to Congress as one of three significant accomplishments funded by the Computer Science Division and covered by Technology Review (June 2003). For continuing this direction of research, we received an NSF Information Technology Research award (2003-2008).

- With Xi Chen and Xiaotie Deng, I solved a major open question in Computational Game Theory. We proved that the problems of finding a Nash equilibrium of a two-player game do not have a fully polynomial-time approximation scheme, unless PPAD is in P. Furthermore, we proved that the smoothed complexity of the classic Lemke-Howson algorithm for game equilibria is not polynomial unless PPAD is in RP. Our paper on these results was invited to *Journal of the ACM*. With Li-Sha

Huang and Paul Valiant, I extended the above two results to market equilibria and Nash equilibria of other forms of games. My proposed research for this year's John Simon Guggenheim Fellowship is built on these works and my work on smoothed analysis.

- With Daniel Spielman, I developed the first local clustering algorithm for massive graphs such as Web-graphs and social-network graphs. Our technique led to the first nearly linear-time algorithms, using graph theory to build preconditioners, for solving a class of symmetric linear systems that arise in practical numerical simulation. Our result solved a decade-old open question posed by Pravin Vaidya. Our technique also led to an new algorithm that I recently co-developed (with Reid Andersen, Jennifer Chayes, Christian Borgs, Vahab Mirronkni of Microsoft and John Hopcraft of Cornell) for spam-detection and for the computation of Web-Graph PageRank contributions. Spielman and I plan to write a book on the topic of spectral theory in combinatorial optimization. I have received three NSF grants, 1998-2001, 2003-2006, and recently 2007-2010 (with Gary Miller, Satish Rao, and Spielman) for my research in spectral graph theory.

- With Gary Miller, William Thurston, and Steve Vavasis, I pioneered the geometric mesh partitioning techniques for finite-element computation in three dimensions. The partitioning algorithm that we developed is the first provably good algorithm for partitioning finite-element meshes in three dimensions. With John Gilbert, I built a Matlab mesh partitioning toolbox based on this theoretical algorithm. Since then various extensions of this software had been used and incorporated in practical software at NASA Ames Research Center and CMU. For this work, I received the NSF CAREER award (1994-1997). Building upon this method, I also developed the first provably good load balancing algorithm for supporting parallel N-body simulation of non-uniformly distributed particles.

- An encouraging interdisciplinary interaction with Horst Simon, the current director of the NERSC Division of Lawrence Berkeley National Laboratory, helped to jump-start my work with Dan Spielman on spectral graph theory. We obtained a mathematical proof of why spectral partitioning methods work in practice, solving a major challenge in combinatorial optimization and numerical linear algebra. Our work also established a new connection between the geometry of graph and its eigenvalues. Both of us were selected as Sloan fellows (1996).

- Since 1994, I have been tackling the three-dimensional mesh generation problem, one of the most fundamental and difficult problems in numerical simulation. With Cheng, Dey, Edelsrunner, and Facello, I introduced a technique called "sliver exudation" which is the first topological approach for removing slivers from three-dimensional Delaunay meshes. Based on this technique, I developed the first provably good Delaunay meshing algorithms for general three dimensional domains with my former Ph.D. student Xiang-Yang Li, solving a long term open question in mesh generation. Our algorithms extended the earlier work of Delaunay refinement pioneered by Paul Chew, Jim Ruppert, and Jonathan Shewchuk and resolved their major technical challenge, the removal of slivers. Software based on this development was used at the University of Illinois for the simulation of advanced rockets. I received the UIUC Senior Xerox Award for Outstanding Faculty Research in 1999 and was promoted to Full professor after this work.

- I have obtained results in several other areas including cryptography, compiler optimization, scheduling, graph embedding, string matching, percolation, parallel algorithms, regression and robust statistics, space-time meshing, sampling, approximation algorithms, and randomized algorithms. These research results appeared in journals such as the Journal of Cryptology, ACM Transactions of Programming Languages and Systems, Discrete Computational Geometry, SIAM Journal on Numerical Analysis.