



IN MEMORIAM

Kenneth Kwai-Hsiang Mei

Professor of Electrical Engineering and Computer Sciences, Emeritus
UC Berkeley
1932 – 2017

Professor Kenneth Kwai-Hsiang Mei (K. K. Mei) was born in Shanghai, China, on May 19, 1932. He attended the National University of Taiwan as a student in the Department of Physics for a year before moving to Madison, Wisconsin. He was awarded his bachelor's, master's and Ph.D. degrees by the University of Wisconsin. In July 1962, he joined the faculty of the Department of Electrical Engineering at the University of California, Berkeley (later becoming the Department of Electrical Engineering and Computer Sciences-EECS). He became a full professor in 1973, and emeritus professor in 1994. He then joined the City University of Hong Kong, and from 1994 to 2007, was professor and chair of the Department of Electronic Engineering. From 1998 to 2002, he was also the director of the Wireless Communications Research Centre of the City University of Hong Kong. Professor Mei died in Oakland, California, on February 16, 2017.

Professor Mei was an exceptional innovator in computational electromagnetics. He introduced enabling constructs such as the “superabsorbing” boundary condition and the “measured equation of invariance” (MEI) method that greatly reduced the mesh size requirements in “finite difference” (FD) and “finite element” (FE) methods for antenna and scattering problems. Professor Mei published more than 120 scientific papers in international journals and at conferences, and holds a patent on a broadside log-periodic antenna. Professor Mei supervised the work of 27 Ph.D. students at Berkeley. Early in his career he received a Special Recognition Award in 1967 for his (Institute of Electronic and Electrical Engineers) *IEEE Transactions on Antennas and Propagation* paper, entitled “Theory of Conical Equiangular Spiral Antennas”. He became a Fellow of IEEE in 1979. For his substantial contributions to computational electromagnetics and

Maxwellian circuits, Professor Mei was awarded the IEEE 2009 Electromagnetics Award, an award jointly sponsored by four IEEE societies: Antennas and Propagation, Electromagnetic Compatibility, Microwave Theory and Techniques, and Geoscience and Remote Sensing.

Professor Mei founded the Ta Hsiung Buddhist Association adjacent to the Berkeley campus. It is an official branch of a Taiwanese Buddhist group of which Professor Mei was member. The association served the Berkeley campus community and provided facilities to the Group in Buddhist Studies for seminars, classes, and forums. Professor Mei was an adjunct faculty member of the group and provided support for several of the activities.

Professor Mei served on the Academic Senate Executive Committee on American Cultures in the early 1990s at the time that the American Cultures course requirement came into being. He also served on the Berkeley Division's Committee on Admissions and Enrollment (from 1987-88 through 1989-90), and chaired an Academic Senate Special Action Committee. Professor Mei was also very active in EECS in modernizing the facilities for high-frequency electromagnetic measurements. He also chaired many EECS committees including undergraduate admissions, undergraduate awards, preliminary exams, scheduling, colloquium, and Cory Hall facilities.

Professor Mei devoted much of his career to the computational challenges in numerically solving differential equations in large and infinite (open) regions. He was well aware of the strengths and computational tractability of both mesh based (FD and FE) methods and boundary based integral (Greens function) equation methods. His Ph.D. dissertation was a pioneering work in the numerical solutions of integral equations, predecessor to the "method of moments". He also addressed the most challenging, long-standing problems in numerically solving differential equations in open regions, mesh termination. In 1974, Professor Mei introduced the "unimoment method" to terminate meshes via linkage with classical separation of variables representations and their simultaneous solution. In an effort to reduce the volume of the mesh in the region where waves were only outgoing, many versions of absorbing (but wave propagation angle dependent) boundary conditions were developed. In 1989, Professor Mei invented "superabsorption" in deriving a new difference equation that cancels the back-reflection of an outward propagating wave to an additional higher order. This also included a method for dynamically adapting the new equation to the effective angle of the outgoing waves being revealed by the ongoing simulation. This method can be applied to every known absorbing boundary condition and yields a dramatic reduction on the numerical error caused by mesh termination reflection.

In 1992, Professor Mei introduced the "measured equation of invariance" (MEI) method. This is a novel concept and yet a simple technique used to derive finite difference type local equations at mesh boundaries, where the conventional finite difference approach fails. The method is based on the postulate of the existence of linear equations of the discretized nodal values of the fields, different from the conventional equations, but leading to the same solutions. Professor Mei showed that the postulated equations are local and invariant to excitation. Thus for a given mesh point with $n-1$

neighbors in any geometry, the coefficients in the linear equation invariant measures can be found from the field distributions for $n-1$ different excitations. Much simpler local excitations such as those of $n-1$ local current distributions on the object can be used, quickly analyzed with the integral equation method, and their fields can then be utilized to solve the linear equations for the coefficients of the invariant measures. The MEI method was first demonstrated for general boundary geometries, including both convex and concave metal surfaces, and then extended to penetrable media where fields exist inside inhomogeneous media. By using measured equations, the finite difference mesh can be made much more conformal to the physical boundary and still obtain robust solutions. The MEI method brings the computation efficiency of the boundary integral method in the method of moments to penetrable media problems. The MEI method is widely cited and has made it possible to even solve many previously difficult large problems on a desktop computer.

Throughout his extensive career Professor Mei introduced fundamental constructs that enable modern computational electromagnetics, addressed previously intractable problems, and trained leading researchers in the field. In addition, he was a great asset to the Ph.D. program in Buddhist Studies and contributed to the spiritual life of the students.

Professor Mei is survived by his second wife, Chiu Huei-Chun from 1989; his children, Cynthia, Audrey, and Ankai; and grandchildren, Malena Caszarry and Pia Hoffmann. He lived most of his life in Berkeley, California, and lived abroad in Hong Kong, Shanghai, and Taiwan, from 1994 to 2012.

Andrew Neureuther
Lewis Lancaster
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