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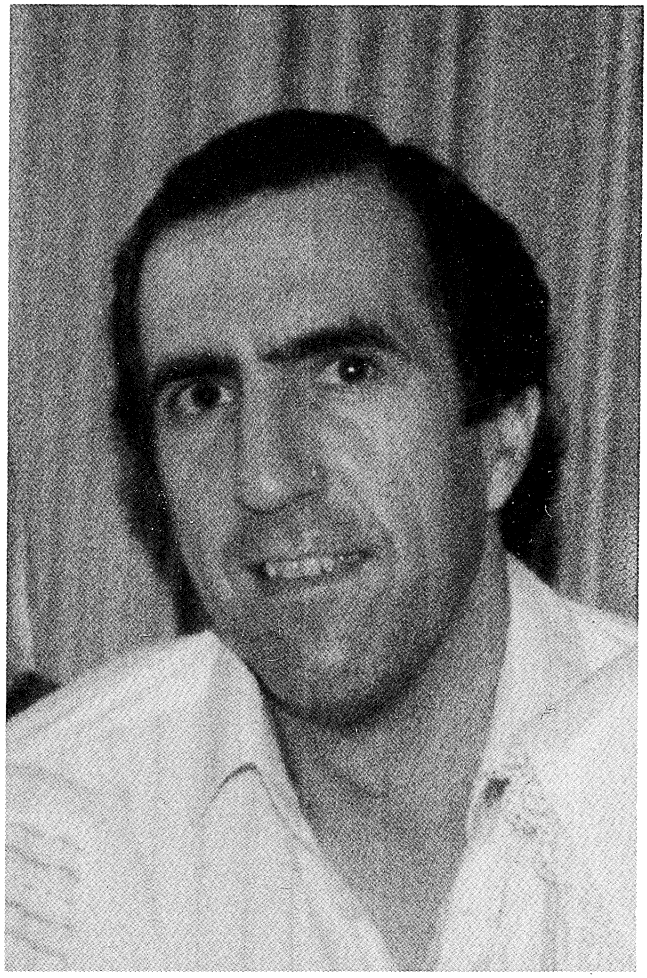

Charles G. Lange
1942–1993

DEDICATION

This special issue of **Methods and Applications of Analysis** is dedicated to the memory of Charles G. Lange, who died on June 25, 1993 after a year-long battle with valley fever (primary *coccidioidomycosis*), a fungal infection of the lung. Lange was one of the Associate Editors of MAA but did not survive to see its first issue. He was an outstanding researcher, an excellent teacher, and a devoted father. Lange was a congenial collaborator and a good friend. He will be greatly missed in the scientific community and by his many friends.

Following this dedication is an obituary of Charles Lange and a list of his publications. The papers in this special issue are written by various researchers who knew Lange and respected his work.

Robert M. Miura
Vancouver, Canada

Roderick S.C. Wong
Kowloon, Hong Kong

November 1994

Charles G. Lange

March 30, 1942 – June 25, 1993

Charles G. Lange, Professor of Mathematics at the University of California, Los Angeles, died June 25, 1993, after a long illness. He was noted for his many contributions to applied mechanics and singular perturbation theory.

Lange was born in 1942 in Chattanooga, Tennessee, where his father worked during World War II making military maps under the auspices of the Tennessee Valley Authority. After the war, his family returned to live in northeastern Indiana. He graduated from high school in the small town of Auburn, Indiana, and later followed his father's footsteps and attended Tri-State College in Angola, Indiana. Upon receiving his Bachelor of Science degree in civil engineering in June 1963, he entered Case Institute of Technology in Cleveland, Ohio. At Case he received a master's degree in applied mechanics, writing a thesis under the direction of Robert Archer. This thesis later appeared as the paper "Nonlinear Dynamic Behavior of Shallow Spherical Shells" in the Journal of the American Institute of Aeronautics and Astronautics. In the fall of 1965, he entered MIT, graduating in 1968 with a doctoral degree in applied mathematics. David Benney directed his thesis, which they jointly published under the title of "The Asymptotics of Nonlinear Diffusion" in Studies in Applied Mathematics.

Lange took an acting assistant professorship at UCLA in the fall of 1968. This temporary position proved permanent. He progressed through the ranks at UCLA, reaching the level of professor in 1984. During the years 1986–88, he served as Graduate Vice Chair of the Mathematics Department. Lange was a well-liked administrator and teacher. Students particularly appreciated his clarity, organization, and humor.

Participation in the national and international scene in applied mathematics held a strong attraction for Lange. He was the organizer of the July, 1991, Minisymposium on Singularly Perturbed Integral and Delay Equations at the Second International Conference on Industrial and Applied Mathematics in Washington, D. C. He was an Associate Editor for the new journal, Methods and Applications of Analysis. He also was a regular summer and sabbatical visitor at the University of British Columbia. Vancouver became something of

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Adapted from an obituary by Gregory A. Kriegsmann, Kenneth L. Lange, Thomas M. Liggett, and Robert M. Miura that appeared in the November 1993 issue of *SIAM News*.

a second home to him. His last sabbatical in 1988-89 was split between the University of British Columbia and Universität Erlangen-Nürnberg in Erlangen, Germany.

Lange was a superb applied mathematician who developed singular perturbation techniques to solve broad classes of difficult mathematical problems arising in many physical contexts. He particularly loved investigating novel types of asymptotic behavior that defy standard numerical methods. His research has had significant impact on such diverse fields as elastic stability, nonlinear diffusion, random waves, linear and nonlinear differential delay equations, integral equations, and boundary-value problems and their associated spectra.

His early papers on shell buckling, for example, clearly brought out the difficult mathematical structure of closely spaced eigenvalues and their effect on the stability of shells. Not only were these results used by structural engineers, but the underlying mathematical problems spawned a tremendous amount of further research in modern bifurcation theory.

In later research, for certain singularly perturbed boundary-value problems, Lange showed that the failure of the method of matched asymptotic expansions to determine the location of certain internal layers can be resolved by explicit matching of exponentially small terms. This was an early example of exponential asymptotics which now is an active area of research with applications to a variety of boundary-value and viscous shock problems with exponentially slow internal layer motion. His recent work on singular perturbations of integral equations revealed a rich class of solution behavior. The widths of boundary and interior layers depend on the nature of the jumps in the kernels.

His series of papers on boundary-value problems for singularly perturbed differential-difference equations show the profound effects which delays and advances can have on solution behavior. Layer behavior, rapid oscillations, turning point behavior, large amplitude solutions, and nonexistence and nonuniqueness of solutions are some of the observed effects. He also studied the effect on the spectra of certain elliptic operators of removing small holes from a two-dimensional domain. For these problems, Lange showed that the perturbed spectra can be expanded in terms of logarithmic gauge functions. Such logarithmic expansions are notorious in a number of other problems, including those in low Reynolds number flow.

One has only to read his papers to be impressed by his ability to cut through a problem's physical complexities and to get to its mathematical heart. He demonstrated a keen intuitive ability to build sequential mathematical model equations, each one capturing more of the problem's physical and mathematical structure until the final fully satisfying answer emerged. He used the same process when he introduced new and difficult concepts to his graduate students, both within and outside the classroom. Both his papers and his teaching

showed a meticulous attention to detail and a love of vigorous, direct language.

Lange was an excellent teacher, with student evaluations typically well above the UCLA average. His enthusiasm and love of mathematics inspired a generation of students. In addition, he was a dedicated graduate student advisor. Although he only directed a few doctoral dissertations, he had an enlightened and novel style of guiding students. It is common and understandable that the theses of most Ph. D. students are extensions of their advisors' research. However, in some sense, this tends to limit a young researcher's horizons; the pressure of promotion and tenure requires a strict adherence to the same line of research. Lange would work closely with a student on a research problem which he had suggested and after reaching a satisfactory result, he would insist that the student define a thesis problem from an application area of his own choice! Although this initially would give the student a large dose of anxiety, in the end the student would have a tremendous pride of ownership in his work and would have a field of scientific interest that would launch his research career. This was his gift to his students.

To his friends, Charles Lange will be remembered best for his zest for life, his preoccupation with indoor gardening, his witticisms and quick sense of humor, his devotion in raising his sons as a single parent, and his kindness and loyalty. Nothing illustrated his character better than his determination to teach and do mathematics even until the very final days of his life. Up to the end, he never surrendered.

He is survived by his three sons, Trent of Los Angeles, California, Ethan of Ann Arbor, Michigan, and Joshua of Pismo Beach, California; his father, Alfred Lange of Huntington, Indiana; his mother, Alma Finelli, of Woodstock, Virginia; and his four brothers, John of Pismo Beach, California, Kenneth of Ann Arbor, Michigan, Eric of St. Louis, Missouri, and Frederick of Huntington, Indiana.

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