FOREWORD

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This issue is dedicated to Michael Shub, in celebration of his first seven decades, in honor of his mathematics, and in appreciation of his guiding vision and efforts in the creation and nourishing of Foundations of Computational Mathematics (FoCM), both the journal and the society.

Mike has made many significant contributions to theory, in two independent areas. Initially, he was a dynamicist, gaining his Ph.D. in 1967 at Berkeley with Steve Smale as advisor. About fifteen years later, Mike broadened his horizons to include computational complexity.

In his Ph.D. thesis, Mike created the basic theory of expanding maps on manifolds in arbitrary dimensions. As these maps provided the first examples of structurally stable strange attractors, Mike's work contributed in an essential way to the revolution in dynamical systems theory now known as chaos theory. Moreover, groundwork laid by Mike led ultimately to expanding maps being classified, by Micha Gromov.

Mike proceeded to study the relationship between smooth dynamics and algebraic topology, resulting in a rich body of research and leading him to formulate the entropy conjecture, later established by Yosef Yomdin in the case of C^∞ maps. Additionally in these years, Mike authored two highly cited books, one arising from an advanced course on dynamical systems (*Global Stability of Dynamical Systems*) and the other with Moe Hirsch and Charles Pugh (*Invariant Manifolds*).

More recently, Mike has worked with Charles on exploring the extent that chaotic dynamical systems can be understood statistically. Their conjecture that volume pre-

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serving partially hyperbolic dynamics are generally stably ergodic has now been verified for a large set of cases.

In the early 1980s, Mike began collaborating with Steve in investigating the computational complexity of algorithms for approximating roots of polynomials, initially for univariate polynomials and later for multivariate systems. By the early 1990s, this collaboration had resulted in a deep and elegant series of papers (Complexity of Bezout's theorem: I–V) that remains the bedrock for the study of the complexity of homotopy algorithms in approximating zeros of systems of polynomial equations.

Mike and Steve conjectured that on average, a root of a polynomial system can be approximated accurately in polynomial time, a conjecture finally settled affirmatively by Carlos Beltrán and Luis Pardo fifteen years later, albeit for a homotopy method with Las Vegas components. Peter Bürgisser and Felipe Cucker then extended the ideas to establish a quasi-polynomial time bound for a deterministic homotopy method.

In the late 1980s, Mike and Steve, together with Lenore Blum, laid the foundations of the complexity theory for real number machines, an achievement that has had major impact, especially on members of the FoCM community. Their work in this vein progressed for years and was elucidated most elegantly in their 1997 book (with Felipe), *Complexity and Real Computation*.

In subsequent years, Mike has continued to vigorously extend the computational theories, in addition to pursuing research on dynamics. Google Scholar helps to reveal his amazing depth in both topics, his impressive collaborators, and most notably, his unceasing passion for creating timeless theory.

Whereas Mike's mathematics is reason enough to devote this issue to celebrating his first seven decades, there also is his centrality to the existence and flourishing of FoCM, both the society and the journal. Indeed, it is likely that neither would exist without him.

The society came into being due to Mike's initiative to build on the spirit surrounding a four-week conference in 1995 spearheaded by Steve. That conference was eclectic in encompassing a dozen diverse mathematical topics connected to computation, with nearly 40 plenary speakers and more than 200 workshop speakers. Thanks to Mike's initiative, what was eclectic back then, now we almost take for granted, in that the same spirit is rejuvenated regularly, at every FoCM conference and event.

Besides having the vision, Mike was the initial leader in gaining recognition and momentum for the society and served as its first Chair. Likewise, he was central to establishing the journal, the founding managing editor.

Between Mike's mathematics and his devotion to FoCM, no one is more deserving of being dedicated an issue of this journal. As additionally Mike is an immeasurably warm and caring person, we feel joyful as well as immensely honored in being the guest editors for celebrating his first seven decades.