Preface

It is indeed an unique privilege and rare honor to be invited by Professor T.E. Simos (Editor-in-Chief) as Guest Editor for this special issue dedicated to Professor M.K. Jain for his contribution to *'Applied Mathematics and Numerical Analysis'*. The innate authority as well as contributions of Prof. M.K. Jain's in the field of *Applied Mathematics and Numerical Analysis* needs no mention. I have been deeply inspired and guided by his knowledge and experience during my academic career and have collaborated closely with him from 1985 – present day. I am fortunate enough to have published many research papers jointly with this great mathematician in various International Journals of repute. His acute hunger for academic excellence can be deduced from the very fact that at this age his research activity is still in great pace. There are many mathematicians produced by him throughout the world to glorify his legacy further. Though a man of International repute his humility, simplicity, leadership and dynamism are praiseworthy. It has been a privilege to have been associated with such an outstanding world figure in the History of Mathematics.

Professor Mahinder Kumar Jain was born on June 1, 1932 at Jharsa, Haryana. He had his early University education in Delhi and had a brilliant academic career at the University. He received his Master's degree in Mathematics from the University of Delhi in 1953. He was awarded D.Phil degree by the University of Calcutta in 1956, and in the same year he was selected on all India basis for a Free Hanseatic City of Hamburg Research Fellowship for advanced study. He studied the numerical solution of differential equations at the Institute of Applied Mathematics, University of Hamburg, West Germany during 1957–1960. On his return to India he submitted his thesis and was awarded D.Sc. degree by IIT Kharagpur. Prof. Jain was first ever recipient of D.Sc. degree from IIT Kharagpur. He was elected a Fellow of the Indian Academy of Sciences in 1976.

Professor M.K. Jain joined the department of Mathematics IIT Kharagpur as a research scholar in 1953 and continued to teach and research in the department as Lecturer and Assistant Professor during the period 1954–1965.

In 1965 Prof. Jain joined the Department of Mathematics at the newly founded Indian Institute of Technology at Delhi. Prof. Jain established a School of Numerical analysis, a newly emerging area in Mathematics, and Computer Centre. For more than four decades, about 35 teachers and research scholars have worked under his inspiring leadership and guidance and many of those who have worked under him are now occupying responsible positions in Technological Institutes and Universities in India and abroad. The present teaching and research in numerical analysis in the country is being done by the pupils of Professor M.K. Jain or those teachers trained by him under the Quality Improvement Programme of Govt. of India, at IIT Delhi. Prof. Jain has published over 125 research papers both in National and International journals.

Professor M.K. Jain has been associated with the Indian Society of Theoretical and Applied Mechanics right from its establishment in 1955. He has been the Secretary-Treasurer for many years of the Society and was elected its President in 1976. Professor Jain has been Visiting Professor at a number of leading foreign Universities: Illinois, Wisconsin, Karlsruhe, Imperial College London and Mauritius.

During the middle of the twentieth century a number of nonlinear theories were proposed and applied to simple viscometric flows to explain the effect of cross viscous forces. Jain [1,2] initiated studies on the

effect of cross-viscous forces in non-Newtonian liquids to two and three-dimensional flows. His analyses of the flow past a sphere and a circular cylinder, and the motion of an infinite cylinder in the rotating non-Newtonian liquid have been incorporated in the books (i) non-Newtonian Flow and Heat Transfer by N. Skiand (Harper and Row, New York, 1967) and (ii) Handbuck der Physik: Principles of Classical Mechanics and Field Theory, III/I, by C. Truesdel and R.A. Touplin (Springer-Verlag, 1960) respectively. Jain [3] was also the first to investigate the effect of cross-viscous forces on the rotational instability (Taylor Stability Problem) and found that the cross-viscous forces inhibit the onset of instability. The effect of temperature on cross-viscous forces was analysed by Jain in 1962 [4] and this has been described in the book Advances in Heat Transfer, Vol. 12 by A.B. Metzner (Academic Press, New York, 1965).

Jain [5] has proposed the Extremal Point Collocation method. The method is applicable to a wide class of problems. This method has been incorporated in the books Nonlinear Partial Differential Equations in Engineering by W.F. Ames (Academic Press, New York, 1965) and Computational Galerkin Methods by C.A.J. Fletcher (Springer-Verlag, 1984).

Jain [6] has used the Legendre series with collocation at the Gaussian nodes for the solution of Linear and nonlinear ordinary differential equations. The method is thus the least square approximations to the solutions of differential equations. The comparison of least square and uniform error-norms shows that the approximate solution may be determined with sufficient accuracy by the Legendre series method. He [7] has also derived error estimates for the Gauss-Legendre and the Gauss-Chebyohev quadrature formulas applied to analytic functions.

In general the recent mathematical formulation of the physical problems lead to one of the following three models: (i) Stiff System, (ii) Highly Oscillatory System and (iii) Convection-Diffusion System. In high speed computation, the efficient and economical methods are high order and strongly stable methods. Jain [8] has worked out a stiffly stable method up to order eleven and has shown that no twelfth order method exists. This result has led a number of research workers to attempt to obtain higher order methods than twelfth in the class of non-multistep methods. This result has been included in the text book Numerical Initial Value Problems in Ordinary Differential Equations by C.W. Gear (Prentice Hall, New Jersey, 1971).

Jain[9] defined the piecewise function called Spline in Compression which is best suited to fit a function or data which has a convex character and to solve the systems which are highly oscillatory. The convection-diffusion problems can also be solved with ease. Further, he has shown that the spline consistency relations are the fundamental equations of the discrete mechanics. He [10] has also developed a second order unconditional stable method for solving nonlinear convection-diffusion problems and no higher order method is possible. In addition Jain [11,12] has investigated adaptive and hybrid numerical methods for solving periodic initial value problems and these are described in the book Stiff Computation edited by R.C. Aiken (Oxford Press, 1985).

Jain [13] has introduced implicit multipoint iterative methods for solving equations. A two-stage implicit fifth-order method, which is both accurate and robust, has been developed. He [14] has also obtained higher order Bairstow's method for polynomial equation.

Jain [15,16] has derived fourth order difference schemes to solve quasi-linear elliptic and parabolic differential equations. The schemes are compact, implicit and based on the minimum number of nodal points. He [17] has also proposed Computer method for solving Linear differential equations as a minimum norm least squares problem with error-bounds justify the quality/validity of the solution. He [18] has determined generalized trapezoidal formula which minimizes the local truncation error. The method when applied to the linear systems with constant matrix attains order three.

Jain [19] has published a book 'Numerical Solution of Differential Equations' [John Wiley (Halsted Press), New York, Wiley Easter, 1979], which incorporates up to date material on the subject.

Professor Jain was appointed as Vice Chancellor of the APS University Rewa (M.P.) in 1989. The highlights of Professor Jain's administrative experience is his contribution to the development of Personal Policy, the management of Central facilities and academic policy making at the Universities and Institute of Technology in the country as a member of many expert committees. He is vitally interested in teaching both at Undergraduate and Postgraduate levels and has taken interest in the welfare schemes for the benefit of teachers and students.

Acknowledgements

Selected Publications of Professor M.K. Jain

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