

Preface

Asymptotic Analysis and Elasticity Theory: A Collection of Papers Dedicated to Professor Philippe G. Ciarlet on the occasion of his 85th birthday

This Special Issue of CMAA (Communications in Mathematical Analysis and Applications) is made of peer reviewed papers dedicated to Professor Philippe G. Ciarlet on the occasion of his 85th birthday. They have been written by friends and colleagues from around the world as a testimony of their admiration for an exceptional mathematician who greatly influenced the development of these mathematical fields.

Philippe Ciarlet was born in Paris, France, on 14 October 1938. He spent his childhood in the beautiful old city of Gien on the Loire river in central France, then moved to Paris to attend the very selective Lycée Louis Le Grand, École Polytechnique, and École Nationale des Ponts et Chaussées, three famous schools in France founded respectively in 1550, 1794, and 1747.

Philippe Ciarlet received his PhD in 1966 and his Doctorat d'État, a higher than PhD degree in France, in 1971. His doctoral studies were completed at the Case Institute of Technology in Cleveland, Ohio, United States, under the supervision of Professor Richard Varga, while his Doctorat d'État was completed at the University of Paris, France, under the supervision of Professor Jacques-Louis Lions.

Professor Philippe Ciarlet started his career in 1966 as head of the Department of Mathematics at Laboratoire Central des Ponts et Chaussées, Paris, France, was full professor between 1974-2002 at the Université Pierre et Marie Curie, Paris, France, was chair professor between 2002-2011 and then university distinguished professor between 2011-2022 at the City University of Hong Kong, Hong Kong, China, and is visiting professor since 2022 at the Institut für Mathematik at Universität Zürich, Zürich, Switzerland, and senior fellow since 2015 of the Hong Kong Institute for Advanced Studies of City University of Hong Kong, Hong Kong, China.

Professor Philippe Ciarlet is one of the most well-known French mathematicians in the world with fundamental contributions in several branches of applied mathematics, from mathematical analysis to finite element methods, and from

differential geometry and functional analysis to the theory of elasticity. Through a close combination of fundamental theories with practical applications, Professor Philippe Ciarlet has achieved a truly exceptional body of outstanding works, which include more than 250 research papers and 17 textbooks, many of which became textbooks of reference in their fields, translated in several languages and used in many Universities for teaching. During a career spanning more than half a century, Professor Philippe Ciarlet had 66 PhD students and influenced the research and careers of numerous other collaborators and admirers.

The important contributions made by Professor Philippe Ciarlet to mathematics and its applications are reflected by the numerous awards and honors he has received. Professor Ciarlet has been awarded the Poncelet Prize from the French Academy of Sciences, the Grand Prize Jaffé from the French Academy of Sciences, the Gold Medal from the University of Santiago de Compostela, the Alexander von Humboldt Research Award, and the Shanghai Prize of International Cooperation in Science and Technology. He is an Officer in the National Order of the Legion of Honor of France, a member, or foreign member, of eight academies, and a Doctor Honoris Causa, or Honorary Professor, in sixteen universities around the world.

Without being comprehensive, the following major contributions of Professor Philippe Ciarlet in mathematics illustrates the width and depth of his research and teaching activities.

1) Numerical analysis. Professor Philippe Ciarlet contributed to the foundations of numerical analysis of finite difference methods and general variational approximation methods, and of the finite element method in general and applied to problems in elasticity and fluid mechanics. In particular, his well-known books “The Finite Element Method for Elliptic Problems” and “Introduction à l’Analyse Numérique Matricielle et à l’Optimisation”, are to this day textbooks of reference for research and teaching in many universities.

2) Mathematical Elasticity. Professor Philippe Ciarlet has had profound contributions to the modeling, mathematical analysis, and numerical simulations in three-dimensional linearized and nonlinear elasticity, in the theory of plates and shells, and in elastic multi-structures that comprise junctions. In particular, he established the existence, multiplicity, and bifurcation of solutions to von Kármán equations, he established convergence theorems justifying the two-dimensional models of “membranar shells”, “generalized membranar shells”, and “flexural shells” in linearized elasticity, and had seminal contributions to the intrinsic approach in elasticity theory. His trilogy of books on the mathematical theory of elasticity, namely “Mathematical Elasticity, Vol. I : Three-Dimensional Elasticity,” “Mathematical Elasticity, Vol. II : Theory of Plates”, and “Mathematical Elasticity,

Vol. III : Theory of Shells”, became an indispensable reading for all students and researchers in this field.

3) Differential Geometry and Functional Analysis. Inspired by their potential applications in the theory of elasticity, the contributions of Professor Philippe Ciarlet in these fields include the theorem establishing the continuous dependence of a surface, with or without boundary, as a function of its fundamental forms in various function spaces, nonlinear Korn inequalities in open subsets of the n -dimensional Euclidean space, nonlinear Korn inequalities on surfaces, weak Saint Venant and Donati compatibility conditions, new variants of Newton-Kantorovich theorem, and an equivalence theorem between several fundamental results in Functional Analysis, such as a lemma of Jacques-Louis Lions, Nečas inequality, and de Rham theorem. Most of these results have been included in his very impressive treatise “Linear and Nonlinear Functional Analysis with Applications”, first published in 2013 and already due to be reprinted in 2025 in a considerably expanded second edition.

Professor Philippe Ciarlet distinguished scientific works and significant contributions to mathematical communities in several countries have profoundly influenced and inspired many of us. On this very special occasion of his 85th birthday, we would like to give him our sincerest congratulations on his achievements up to now and best wishes for his future projects.

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