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Foreword

by
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Nowadays a considerable progress has been achieved in the different areas of mathematics and most of it was motivated by applications. Indeed, the abstract character of mathematical tools allows us to solve wide classes of problems which illustrate a common feature and to provide significant applications in the study of problems arising in sciences, engineering and everyday life.

The Theory of Variational Inequalities has not been an exception. The cross fertilization between modelling and applications on the one hand and nonlinear mathematical analysis on the other hand was an important aspect which contributed to its development during the last four decades. Currently, the Theory of Variational Inequalities became a fully mature discipline which deals with existence, uniqueness, regularity and continuous dependence results, together with numerical approximations and optimal control of the solutions. It provides results which are of considerable theoretical and applied interest.

One of the major applications of the Variational Inequalities arise in the study of mathematical analysis of various problems involved in contact between deformable bodies. Mechanical processes involving contact between solid bodies are abundant in industry and everyday life and play an important role in engineering structures and systems. They include a large variety of surface phenomena like friction, wear and adhesion, and therefore are modelled by highly complex nonlinear initial-boundary value problems. The need for a comprehensive well posed mathematical theory, based on fundamental physical principles, that can predict reliably the evolution of solid bodies in different situations and under various conditions, was recognized long ago, but the tools needed for realizing this goal have been developed only in recent years. Such a mathematical theory is emerging currently. It deals with the rigorous modeling of these processes, their variational analysis and their numerical approximation. It uses advanced mathematical methods and results from such topics as variational inequalities, convex and non-convex analysis, set-valued operators, evolutionary equations, finite difference and finite element approximation.

The aim of this special issue of *Bulletin de la Société Roumaine de Mathématiques* is to illustrate the above discussion by some recent contributions to the study of nonlinear problems in Contact Mechanics, exemplifying the importance

of this field. In our opinion, the authors did a very nice job which shows the interplay of Mathematics and Mechanics. No doubt, this will continue to inspire a broad deal of research in the coming years. The volume contains nine papers that have been gone through a rigorous refereeing process. The papers selected present a large variety of results which cover the path starting from the mathematical models and ending with the numerical solution and engineering applications.

We wish to express our gratitude to authors for their valuable contribution to this special issue. We really appreciate their professional job in the achievement of this volume. We extend our thanks to the Reviewers for their very helpful comments that have improved the final versions of some papers.

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