

Proceedings of the First International Symposium on Impact and Friction of Solids, Structures, and Intelligent Structures

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Preface

This volume of Stability, Vibration and Control of Systems contains the proceedings of the first symposium on Impact and Friction of Solids, Structures, and Intelligent Machines, that took place in Ottawa Congress Center, Ottawa, Canada, June 27-30, 1998. The purpose of the symposium was to bring together engineers and scientists concerned with modelling, analysis, measurement and control of mechanical systems in presence of impact and friction. It was also the aim of this workshop to stimulate cross-fertilization of different disciplines involved in the impact and frictional aspects of solids, structures and machines and to promote the fundamentals as well as industrial applications. A total of 79 participants from 23 countries played an active role during the lectures and sessions of contributed papers.

The book is about dynamics of mechanical systems in presence of impact and friction. Impact and friction are usually introduced and studied during elementary courses in physics. Thus, one may think these topics are simple and well understood. However, nothing could be more complicated and less mature than the study of impact and friction in mechanical systems. Contact mechanics has been studied by many of the brightest scientists, e.g., Newton, Coulomb, Reynolds, Hertz, and Sommerfeld. In spite of its importance from a practical view, it is of great theoretical interest and involves fundamental physics, e.g. questions related to the origin of irreversibility and adiabaticity, the role of self-organized criticality and, dynamical phase transitions in molecularly thin lubricant layers. Modern contact laws lead to mathematical models that are highly nonlinear, discontinuous and nonsmooth. Discontinuous and/or nonsmooth processes introduce problems with data processing techniques such as phase-space reconstructions, and analytical techniques such as perturbation methods and linearization in

the vicinity of equilibria. Today due to great advances in computer technology and computational analysis (advances in calculating branching behavior of BVP's, nonsmooth convex analysis, differential inclusions, and the design of proper numerical solution methods for inequality constrained optimization problems), it is possible to solve complex contact problems. Furthermore, new experimental devices, such as atomic force microscope and quartz-crystal-microbalance probe allow other aspects of contact mechanics to have potentially important applications in nano-tribology. In short, the study of impact and friction, which is one of the oldest problems in physics, is in a phase of rapid and exciting development. These growing research breakthroughs have promoted the development of new technologies in the description and design of systems with impact and friction models, to understand nature, structures, machines, transportation systems, and other processes.

In this volume on Stability, Vibration and Control of Systems, research papers on certain selected topics have been compiled to form an integrated set. Being aware that it is not possible to do justice to each paper in this preface, we have attempted to group them under the following headings:

- Inelasticity, Hysteresis, Wear - Stability and Structures - Non-linear Dynamics and Vibrations - Nonlinear Dynamics and Experiments - Analysis, Rigid Bodies, Multi-Body Systems, Mechanics and Contact Models - Applications, Rotating Systems
- Modeling, Computations

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- The Canadian Society for Mechanical Engineering -Institute for Structronics, Ottawa, Canada -Worcester Polytechnic Institute, USA -Linkoping University, Sweden -Stochastic Mechanics/Analysis Research Group, Worcester, USA

The International Program Committee of ISIFSM98 was composed of:

- Brian Feeny (Michigan State University, USA) -Ardeshir Guran (Institute for Structronics, Canada) -Yukio Ishida (Nagoya University, Japan) -Anders Klarbring (Linkoping University, Sweden) -Panagiotis Panagiotopoulos (Aristotle University, Greece)

All members of the IPC played a key role both in the the organization of the ISIFSM98 and in the editing of this book. It was with shock and deep sadness that we learned of the sudden passing of Professor Panagiotis Panagiotopoulos shortly after the ISIFSM98 meeting on 12 August, 1998. Dr.Panagiotopoulos was a prolific scholar in theoretical and applied mechanics. He produced excellent fundamental research while simultaneously

promoting the practical applications of mechanics to industrial problems. The mechanics community has lost a great scholar, the profession has lost an energetic champion and many of us have lost a warm and charming friend. He will be always remembered as a true scholar, a thoughtful person, and a gentleman. He will be greatly missed. This modest volume is dedicated to his memory.

Ardeshir Guran
Ottawa, October 1998