

PREFACE

The *European Conference on Smart Systems* was held in Rome during the period 26–28 October 2006. The present volume contains the papers of several lectures delivered at the Conference and provides an overview of the activities carried out within the Research and Training Network “New Materials, Adaptive Systems and their Nonlinearities: Modeling, Control and Numerical Simulation” supported by the European Commission within the 5th Framework Programme.

The aim of the book is to present a multidisciplinary approach to smart systems from both the engineering and the mathematical perspectives.

The originality relies on the necessity of a cross-discipline approach. Actually interaction between such disciplines as applied mathematics, physics, structural mechanics, fluid mechanics, computer sciences is necessary in order to deal with the field of smart systems.

“New materials” is used here as a generic term for functional materials such as piezoelectric, magnetostrictive, electrostrictive materials, piezoceramics, electrorheological fluids, shape memory alloys, whose physical or chemical properties are used in the design of intelligent systems. Their use as control elements, for example, is widespread: sensors or actuators bonded to a surface or embedded within the structure yielding smart structures or adaptive structures that can be monitored and controlled. Due to recent developments in miniaturization, active transducers are present in almost all domains of industry from telecommunications to optics, biomechanics and environment and they are used even in extreme environments: high pressure, high temperature, presence of radiations. They are now very popular in various applications in particular through MOEMS (Micro Optical-Electrical-Mechanical Systems): adaptive micro-mirrors, micro-accelerometers, capacitive microphones, pressure sensors, micro-positioners, ultrasonics transducers, noise reduction, vibrations suppressor, damage detection.

Another challenge, rarely addressed, is the question of nonlinearity, which is an important aspect inherent to adaptive structures. Nonlinear

problems appear, among others, when hysteresis has to be dealt with, or when phase transitions occur in shape memory alloys.

The application-oriented approach followed by the research team aims at reducing the gap and reinforcing the ties between engineers and applied mathematicians. It has been designated to provide mathematical tools dedicated to a better understanding of the behavior of complex systems and of the associated control strategies. The results will hopefully help improve the performances of technical devices and applications, or even invent new ones.

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The Editors

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