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PREFACE

Advances in stability, bifurcations and nonlinear vibrations in mechanical systems

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The present Special Issue was initially conceived for presenting a survey of recent studies carried out by researchers participating in the Dynamics and Stability Group (GADeS) within the Italian Society of Theoretical and Applied Mechanics (AIMETA). GADeS was founded in 2011 thanks to the initiative of Prof. Angelo Luongo, under the umbrella of AIMETA, with the aim of sharing knowledge on the topics of dynamics and stability across different research fields, including applied mathematics, civil and mechanical engineering. Specifically, this Special Issue was supposed to present the developments of some of the research presented at the most recent GADeS symposium as part of the 2019 AIMETA Conference.

The breadth of the topics covered and their importance at an international level led us, in agreement and with the support of the Editor-in-Chief, Prof. Walter Lacarbonara, to enlarge the domestic viewpoint, and to consider a fully international Special Issue by inviting worldwide renowned scientists in order to give a broader view on recent advances in stability, bifurcations and nonlinear vibrations that may involve different kinds of mechanical systems. Actually, while having old and well-consolidated roots, this is a modern, active and challenging research field, with new applications in science and engineering and lots of new exciting developments.

The papers selected for the present Special Issue can be roughly collected into four broad areas, each collecting a certain number of papers, all related to the aforementioned topics.

A first grouping of papers deals with problems of stability and bifurcations arising in fluid/structure problems with a special emphasis on aeroelastic systems. Problems related to flutter analysis in classical or supersonic conditions [1–3], vortex-induced vibrations [4, 5] and galloping instabilities [6, 7] are thoughtfully addressed, together with more theoretical

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problems related to the Ziegler column [8] and the existence of global attractors in subsonic flows [9].

A second grouping of papers addresses vibration control. One paper deals with a passive control method incorporating a nonlinear energy sink [10], while two papers address active control in sliding mode [11] or by command shaping [12]. The problems of time-delay dynamics with a perspective on control are also investigated with the development of a continuation method [13] and the analysis of active control for a rotating beam [14].

A third grouping tackles problems arising in the field of reduced-order modeling for nonlinear vibration problems. Friction is addressed via adaptive basis [15] and substructuring [16]. Nonconservative nonlinearities are treated with an extended energy balance method [17], while geometric nonlinearities are addressed by comparing modal derivatives to invariant manifolds obtained from normal form theory [18].

The last grouping of papers addresses new frontiers and emerging problems in the general theory of nonlinear vibrations. Stability and bifurcation problems have been addressed for a long time due to their importance in physics and engineering applications, and a large part of the theory, as well as dedicated applications, is now well covered in the literature. Research in this general area is nonetheless still very active with new frontiers and new problems appearing due to additional complexities. These new frontiers are covered in this Special Issue by addressing problems related to global bifurcations [19], stability of nonlinear normal modes [20], localization of symmetric systems [21], identification of backbone curves [22], modal energy exchange [23], vibro-impact [24], internal resonance [25] and hysteretic systems [26]. Gyroscopic effects are also addressed for continuous rotor systems [27], and the nonlinear dynamics and stability of fiber reinforced polymer structures [28], and plates with nonlinear fractional damping [29], are also investigated. The question of tailoring the nonlinear response of a mechanical system is also studied from a theoretical perspective [30].

We thank all colleagues who enthusiastically contributed with their latest results. We also hope that our initiative is welcome and timely and that this Special Issue will stimulate new ideas and new challenges in the wide and fascinating research field of dynamics and stability of mechanical systems.

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