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## **HABILITATION THESIS**

**Dynamic Analysis regarding the Capability and Performances  
of Vibration Isolation Systems**

**Abstract**

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The researches of the author within the area of vibration isolation were initiated since 2001 year, starting with participation into the *”Device and system intended for seismic protection”* and *”Elastic system with polygonal configuration for seismic protection of equipments”* research projects respectively. Doctoral thesis submitted in 2006, with the title *”Dynamic analysis of vibration isolation systems for embedded equipments into constructions”* was realized based on theoretical, computational and especially experimental results, obtained in the field of passive isolation of vibration with elastomeric-based systems and devices having variable structural and functional configurations. After the PhD granted in the field of mechanical engineering, in 2007 year, continuation and extension of the studies in this area followed, in a natural way, the desire of knowledge profound study, of experimental improvement and, obviously, of theoretical substantiation of the phenomenon ensemble remarked in practice and/or evaluated by the numerical simulation techniques.

The researches within this area were performed both in the frame of scientifically projects, by personal or partnership coordination, with dedicated or interdisciplinary thematic, and in the frame of master students coordination and, respectively, doctoral students guidance at IOSUD *”Dunărea de Jos”* University of Galați – Doctoral School of Engineering. It is mentioned that the studies and researches in the thematically area of vibration isolation systems was performed and developed at the *Research Institute for Construction Equipments and Technologies – ICECON SA* Bucharest and, respectively, at the *Research Centre for Mechanics of Machines and Technological Equipments*, within Engineering and Agronomy Faculty in Braila, *”Dunărea de Jos”* University of Galați.

A quantitative and qualitative systematization of the gained outcomes within this period of time lead to the results as follows: 20 scientifically papers indexed by the Web-of-Science<sup>TM</sup> (WoS – Thompson Reuters) scientific database – from which 4 in journals with evaluated impact factor, 26 indexed by Scopus<sup>TM</sup> database, 14 citations in journals with ISI metrics (WoS–SCIE database file, Thompson Reuters), 30 citations in journals indexed by other various international databases, 3 chapters in collective volumes – from which two edited under the auspices of Romanian Academy and over 60 presentations in the national and international conferences, by a total of 305 works identified and indexed by the GoogleAcademic<sup>TM</sup> database.

Within this context, the habilitation thesis with the title *”Dynamic analysis regarding the capability and performances of vibration isolation systems”* is looked upon as an harmonized and unitary

frame for dissemination of the information acquired until present, in the field of behavioral analysis of the vibration isolation systems, which was based on systematization and coherent evaluation of gained results, regarding both the capability and the performances of this category of dynamic systems.

In the first chapter was presented the acquired results in the field of *dynamic analysis of the passive isolation of vibration with the elastomeric-based devices*. *Linear and nonlinear theoretical approaches, numerical simulations and computational analyses*, also the *tests made on experimental models*, even there are distinct parts of this chapter, institute an operational frame, thicken and coherent, intended to both capability characterization, and performances analysis of the vibration isolation systems. The theoretical studies was performed in the sense of limitations / restrictions underlining, imposed by the classical linear models, of opportunities evaluation provided by the linear generalized models, and of identification of nonlinear aspects – proving real implementation possibilities – being able to supply correlated results with the available experimental database. Numerical simulations and computational analyses was developed taking into account the theoretical aspects previously identified and substantiated, in proven of capability and level of confidence for computational approaches upon numerical models. Experimental tests were done in the view of dignifying some behavioral aspects within dynamic regime, being able to provide useful information for tuning of nonlinear models. With respect in the analyzed aspect, it was considered both vibration isolation devices made in one piece, and the complex systems with reconfigurable structure having polygonal or ranged-in-tiers type.

The second chapter of this habilitation thesis was intended to the *dynamic response evaluation within transitory regime of elastomeric-based devices for vibration isolation*. Two main directions were approached in this chapter as follows: *the analysis of the thermo-mechanical effects into the elastomeric core of vibration isolators* and, respectively, *the estimation / evaluation of structural and functional degradation state* during the specifically exploitation regime of these isolators. The unitary aspect of the presented results within this chapter is justified by the operational method used for analysis, which was *the analysis of the changes of dynamic characteristic*. The aspects taken into account was related with the following assessments: the energy dissipation inside the volume of elastomeric material that supply the core of the isolation device – with respect in their configuration and the external applied stress, the damping influence about the evolution of dynamic parameters, and, respectively, the correlative analysis between the level of structural integrity loss (degradation) and the changes induced on dynamic characteristic of vibration isolator. The tests were performed on both numerical simulations, and experimental models.

Inside the chapter three was presented a set of acquired results in the area of *devices and systems intended to vibration and structural noise mitigation*. The two main directions, named *noise protection* and *vibration isolation* respectively, were underlined through distinct approaches of noticeable achievements with direct applications into the engineering practice. *The analysis of dynamic regime*, with the purpose of correlative evaluation of capability and performances of vibration isolation devices having functional reconfigurable structure, and also of sound isolation structures based on recycled materials, made up the main concerns of the author.

The last chapter of the thesis – chapter four – was designated for presentation of the *future directions for scientifically and academically development* of the author's career, in the fields of mechanical engineering, especially in the competences areas gained and profound studied through performed researches and acquired results.

Finally, it were presented the author's papers (unique author or team member) supposed to be relevant within the thematic area of this habilitation thesis and to justify the underlined competences along the professional line, and also the complete bibliography of the thesis.