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HABILITATION THESIS

CAPABILITY PERFORMANCES ANALYSIS OF THE TECHNOLOGICAL EQUIPMENTS WITH VARIOUS DYNAMIC REGIMES

Abstract

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Habilitation thesis with the title "*Capability Performances Analysis of the Technological Equipments with Various Dynamic Regimes*" presents a part of the author research activity performed after PhD thesis submission, and treating "*The dynamic state analysis of the speed frontal loaders to estimate quality performance*", in 2006 year, at "Dunarea de Jos" University of Galati, in the Mechanical Engineering Field (according to O.M. no. 5764 / 28.11.2006).

Habilitation thesis is structured in two parts as follows:

- scientific and professional achievements;
- perspectives regarding the career evolution and development, directly referring on the professional and educational experiences, scientific research activities, respectively the academic and scientific research development plans.

The author has started her activity in the field of technological equipments for construction since 1996, at the *Research Institute for Construction Equipments and Technologies – ICECON S.A.* in Bucharest, as a design engineer and, since 1998, as a research scientist.

The researches in the area of technological equipment for construction have performed in the last 10 years within the research projects gained on national programs and through elaboration of technical regulations approved by M.D.R.A.P. In addition, the studies were done both as a scientific coordinator of the master students activities within *Engineering and Agronomy Faculty in Braila*, and as a member of the coordination of doctoral students within *IOSUD "Dunarea de Jos" of Galati – Engineering Doctoral School*. All these researches have been performed and developed both at the *Research Centre for Mechanics of the Machines and Technological Equipments*, within *Engineering and Agronomy Faculty in Braila*, and respectively at the *Research Institute for Construction Equipments and Technologies – ICECON S.A.* Bucharest.

The results of the researches developed within this period were concretized through the following issues: 12 scientific papers indexed in Web-of-Science[®] (Thompson Reuters) database – from which 2 within impact factor journals, 15 indexed in Scopus[®] database, 6 citations in ISI Journals (Thompson Reuters), 26 citations in journals indexed in various international databases, 1 chapter in collective volume under the auspices of Romanian Academy, and over 45 presentations in various national and international conferences, from a total of 70 papers identified and indexed in the Google Academic[®] database. The author has been involved in 12 projects and research, development and innovation programs as director (4) or as a team member (8). Also, the author has participated in the elaboration of 5 normative documents of regulatory-related technical equipments used in construction technology.

The habilitation thesis, with the title "*Capability Performances Analysis of the Technological Equipments with Various Dynamic Regimes*", is substantiated, in an unitary way, on performed researches and respectively on the published results, from the last 10 years, on scientific papers – according to the thesis bibliography, which dignifies the competences area of the author in the field of capability analysis for technological equipments used in construction.

Through this research, new concepts, dynamic models and mathematical formulations have been developed, which are able to provide a solid base for complex analysis with the help of computational applications regarding case studies occurring within engineering practice in the field of construction technological equipment.

Taking into account the scientific and professional achievements, concretized by the author activity until now, the first part of the thesis has mainly three directions structured as follows:

- *dynamics of construction technological equipments* with various dynamic regimes;
- *working tool – terrain interaction study* for the case of construction technological equipments;
- *evaluation of the working process quality based on capability performances of the construction technological equipments for embankments works.*

Performed research activities were materialized through elaboration and developing some linear and especially nonlinear dynamic models, intended for interaction process analysis between the specific working tools (e.g. bucket, blade, tooth, drum, rammer, etc.) and terrain, for a large range of technological equipments used for embankment works.

Theoretical approaches were added with computational simulations on numerical models and validated through gained results within the experimental tests, done in both laboratory, and “in-situ” conditions.

All research ensemble developed on, one hand, in the area of interactions between working tool and terrain, and on the other hand, in the field of technological equipments dynamics, has had the main purpose in identification, evaluation and analysis of relevant aspects due to various specifically working processes (technological vibration and shocks, preponderant transitory regimes, speedy working cycles, etc.) with direct impact in technological equipment optimization in the view of increasing those capability performances. A part of these results was included in national technical regulations, where the author of this thesis has directly participated.

The first chapter, with the title “*Dynamic behavior of technological equipments with various and speedy working regimes*”, deals with the gained results in the area of dynamics of technological equipments with various dynamic regimes, taking into account a set of significant influence factors on those capability performances. Hereby, numerical simulations, computational analysis and experimental tests were developed to approach the following concrete situations: moving of the equipment over roughness ways, characterization of vibration generated into structural parts of technological equipment, behavioral studies regarding dynamic regimes of working tools with linear / nonlinear aspects highlighting, the analysis of dynamics of the driving systems, etc.

The second chapter, entitled “*Dynamic behavior of technological equipments with technological vibration and shocks*”, contains the significant results gained within the studies performed by numerical simulations of the interactions between working tools and terrain for the case of construction technological equipment. For a large range of interactions (e.g. loader bucket – terrain, dozer/grader blade – terrain, scarifying tooth – terrain, vibratory compaction drum – terrain, vibratory rammer – terrain, etc.) were identified the dynamical responses of inter-correlated parts subjected by disturbing factors, depending on the terrain characteristics, by the variations of the driving system parameters, or by the specificity and variability of technological process.

The third chapter of the thesis, entitled “*The evaluation of level of performance and capability for equipment with various dynamic regimes*”, presents the elements regarding the characterization of the working process quality, based on capability performances of technological equipments for embankment works, through the settling of measured parameters, with predicted threshold level, which materialize the objective elements for control within the quality process assurance. These researches of the author constitute an efficient and coherent approaching for a technological process characterization connected to working tools, for gaining the predictable performance. All these aspects were included in normative documents, specifications and technical regulations in the field of construction technological equipment.

The fourth chapter of the thesis, with the title “*Concepts and methods for analysis of research predictability regarding the technical solutions of technological equipments with superior evolutive performances*”, is a natural continuation of previously chapter and is based on actual tendencies remarked into the designing of automotive technological equipments used in construction field, as follows: load stabilization through shocks minimization within hydraulic system, permanently control of the hydraulic system through continuously detection of the load variation, positional control of working tool, real-time correlation of working regime of main parameters of the “in-situ” technological process in respect with effective terrain characteristics, remote control of the equipments, optimization of the energetically requirements required by different phases of working cycle, etc. The justification of this chapter background is sustained by the fact that all these aspects effectively influence the capability performances of automotive technological equipments within the working area at embankment tasks.

In chapter five, entitled “*The strategy of scientific and academic career developing*”, are presented the future directions for scientific and academic career developing, in the area of competences gained by the acquired researches and obtained results, underlining the aspiration for doctoral thesis coordinating, in the field of mechanical engineering, especially regarding the analysis of capability performances of technological equipments with dynamic regimes characterized by specifically intensity and variability according to the working processes.

Finally, the main references and the proper scientific works (as single author or co-author) are mentioned, supposed to be relevant in the area of this habilitation thesis.