
HABILITATION THESIS

- ABSTRACT -

**CONTRIBUTIONS ON THE ACTION OF MECHANICAL VIBRATIONS
IN THE INDUSTRIAL ENVIRONMENT ON VIBRATING TABLES AND
OPERATORS**

Ass. Prof. Ph. D Eng. Aurora Felicia CRISTEA

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The Habilitation Thesis aims to highlight the research on the undersigned's personal activity over the last decade, both in terms of professional activity and especially of research activity.

The thesis makes an easy and thorough presentation of the research in the field, so that each chapter explains the studies and the calculation for mathematical modeling and validates the results obtained, either by reproducing these examples in simulations, or through experimentally measured data and subsequently analyzed.

This helped me to coordinate what I knew with what is new and to see it better as a whole.

This thesis also intended to include in a presentation as balanced as possible both the knowledge acquired through the study of the specialized literature, as well as new elements of knowledge as own contributions.

The paper has three study parts, the last two being somewhat complementary and all three deal with the influence of vibrations either on humans or on equipment and machine tools.

Study 1 is a continuation of the doctoral thesis field continued through a post-doctoral fellowship and deals with the creation and development of a vibration-dissipating device for workplaces with high transmission of mechanical vibrations, a device mounted on the hand-arm system and patented (Patent No. 128900/2018). The latest research in this field concludes with contributions from the point of view of ergonomics brought to the device and with the publication of a high-impact, review-type paper. This device is mathematically modeled for the hand-arm system, after sketching the model, writing and obtaining the solutions of the equations, the system is simulated using Simulink in Matlab. The damping components of the vibration dissipating device and the dampers are chosen to correspond by course to the system displacements resulting from the theoretical calculations. The dissipation device is practically made in a rough form and the first measurements are made, measurements that have validated the theoretical results in a percentage of 45%.

The latest research on this subject has brought contributions from the point of view of ergonomics to the dissipation device, called DIAV. Contributions from the point of view of shape comfort of wearing, mounting on the arm and the materials used, so that not all of this disturbs the activity of the person wearing it.

Study 2 and Study 3 are somewhat complementary, dealing with compaction vibrating tables used in construction and the fruit and vegetable sorting vibrating tables. Since I will summarize them in a few words, I will specify the basic components necessary for their operation: frame + sieve + lamellas or elastic rubbers and exciter motors.

Study 2 dealt with the compaction vibrating table called COMP, starting from models given in specialized literature and calculating, designing the table components at large sizes up to 10m. Calculations were made of the forces given by the motors and the number of motors required, as well as the simulation of the movement of its sieve. Finally, it describes the advantages and disadvantages of using such large compaction tables.

Study 3 presents the vegetable and fruit sorting vibrating table called VISO. The study of this table starts from a real case, encountered in a project with an industrial environment, where the table having a very long length cracked and finally broke. The company requested quick short-term solutions so that production would not stagnate in the long term.

The study began with a consultation of the specialized literature regarding these vibrating tables and it was found that this table was atypical both in shape (adapted to the production hall) and in length, it had a very long length of 10m, and the support legs were only at the ends, considering the fluency of the personnel in the hall. Another aspect that

caught our attention was from the beginning, when studying the project, no resistance calculations were performed on the dynamic components, the centers of mass of the table components (frame, sieve) were not brought onto the same axis in the initial phase of movement, etc.

The modeling of the vibrating table was done by writing and solving equations, and the movements of the basic components of the table (sieve and frame) were simulated. The harmonics of the table were calculated so that it would not enter the resonance zone and it was noted that changing the number of blades on the table too often to influence the movement of the sieve is not an acceptable technical solution. The table was redesigned to the same dimensions, but the materials and number of elastic lamellas, that connected the frame to the vibrating sieve, were changed and finally, the table movements were simulated under both static and dynamic actions. From all these studies, the required conclusions emerged, respectively the short- and long-term ones regarding the VISO table. To ensure the validation of these results to an even higher percentage, measurements were performed on a vibrating table that almost cloned the VISO table.

The scientific results show that vibrations, a field of mechanical engineering, influence the proper functioning of machines and equipment in terms of efficiency, work operations, reliability and durability. This was also shown in the paper [Cristea A. F., Haragăș S., 2018 – from Proceedings of the Romanian Academy] in which it was proven that the static lubrication of a mold is influenced by the occurrence of vibrations if the oil is not additive.

Also, in the conclusions of studies 2 and 3 it was mentioned that maintenance is an important branch in maintaining the proper functioning of machinery, as well as in preventing and reducing unwanted vibrations occurring in machines and equipment.

The last part of the paper presents the conclusions regarding the studies presented, including general and particular considerations for Future research directions in the field.

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Ass. Prof. Ph D Eng. Aurora Felicia Cristea