

University of Szeged

FACULTY OF ENGINEERING, Department of Technology

dr. habil István BÍRÓ

REPORT

on the thesis entitled: CONTRIBUTIONS TO THE INVESTIGATION OF DEVICES FOR TRANSFORMING ROTATIONAL MOTION INTO UNIDIRECTIONAL LINEAR MOTION – elaborated by ing. Attila GERÖCS for obtaining the title of doctor in the field of Mechanical Engineering.

The above mentioned doctoral dissertation addresses a topic of great relevance and theoretical and practical importance in the context of the development of mechanical engineering.

An application of devices for transforming rotational motion into linear motion unidirectional is represented by inertial propulsion systems. They are part of a promising field of research and, therefore, in recent decades, have received special attention from engineers and researchers. These mechanisms are multi-body systems, with masses in eccentric motion, being built in a usual, symmetrical way, to cancel the unwanted forces in the direction perpendicular to the desired direction of movement. The displacement is ensured by a propulsive force generated as a result of the reaction to the centrifugal forces acting on a number of masses rotating on an eccentric trajectory.

CONTENT OF THE WORK

The thesis is structured in five chapters.

Chapter 1 "The current state of research on inertial motion transformation mechanisms" reviews the most significant examples of inertial motion transformation mechanisms and finally presents a classification of them. All types are discussed, including theoretical models, numerical simulations and experimental validations.

The author aims to:

- Analyze the research in the field of similar structures and identify the current state of research by classification of inertial mechanisms can be found in different patents and in the literature.

- Classify the inertial mechanisms from different point of view such as
 - the system that provides direction of travel
 - the type of inertial force
 - the type of energy consumption
 - the state of the body in which it occurs force of inertia

Chapter 2 "Study of the inertial device with radial slots and circular retaining disc" presents a device designed by the author, for which a patent application was filed with OSIM, the principle of generating traction force, kinematic and dynamic analysis of the system, the influence of the main geometric elements of the device on the traction force, the calculation of the power required to drive the system, the calculation of the moment necessary to drive the system, the calculation of the system efficiency and the influence of the main geometric parameters of the system.

Chapter 3 "Selection of the most efficient version of the inertial propulsion system" details how to choose the optimal construction version of the system using SolidWorks software facilities, based on the criterion of achieving maximum travel with minimum power consumption.

The author aims to:

- create numerical models and make simulation of the device
- make analytical investigation of the three proposed constructive variants
- compare the data obtained analytically with the results of numerical simulations
- choose the optimal constructive variant.

Chapter 4 "Prototype construction and experimental measurements" presents the details regarding the construction of the prototype, the measurement data and experimental determinations performed on the constructed prototype and the comparison of the experimental results with those resulting from the simulation. It is needed to remark this is one of most important and valuable part of the thesis work.

Chapter 5 "Final Conclusions and Personal Contributions. Future directions of research. Dissemination of results" contains the conclusions drawn from research conducted in this thesis, highlights personal contributions and details papers published in journals and presented at national and international conferences.

AUTHOR 'S CONTRIBUTIONS

Below are briefly presented the original personal contributions that this thesis brings in the field studied:

1. Analysis of the research in the field of similar structures and identify the current state of research by classification of inertial mechanisms can be found in different patents and in the literature moreover the classification of the inertial mechanisms from different point of view. This comprehensive study of existing structures is a very valuable part of the work.
2. On the basis of this study a new construction was performed as a result of analysis and investigation of different construction.
3. The field is interdisciplinary and this made it necessary to study works and literature in mechanics, analysis of civil structures, mathematics and numerical methods.
4. Experimental results with results obtained from the simulation were compared.

FINAL CONCLUSIONS

Following the review of the thesis entitled: CONTRIBUTIONS TO THE INVESTIGATION OF DEVICES FOR TRANSFORMING ROTATIONAL MOTION INTO UNIDIRECTIONAL LINEAR MOTION, the following conclusions can be drawn:

- The topic of this doctoral thesis is very important and timely;
- The work in content fully respects the proposed topic and satisfies the requirements imposed for a doctoral thesis;
- The doctoral student studied thoroughly the current stages of scientific literature and patents can be found relating to the main topic;
- Due to the interdisciplinary character of the thesis the author proved his suitability for making scientific work.
- The form of presentation and the content, come to prove the fact that the doctoral student possesses not only theoretical but also practical knowledge;
- The way of illustrating the results, obtained through diagrams and graphs, is clear, the language is concise and of high scientific standing;
- The thesis meets all the elaboration requirements related to the doctoral theses, according to the CNATDCU criteria;
- Finally, through the results obtained, the doctoral student convinces us of the accuracy, seriousness and special exigency in the elaboration of works of high scientific standing.

During the preparation of this thesis, 9 papers were published (ISI / WOS - 2, SCOPUS - 2, BDI - 2, international conferences - 3) in proceedings or in journals. and 2 patents filed with OSIM.

Consequently, the undersigned István BÍRÓ, associated professor at the Faculty of Engineering of the University of SZEGED, Hungary, appointed by order of the rector of the University Eftimie Murgu from Reșița with no. 237 / 27.08.2020 in the commission for the analysis of the doctoral thesis entitled: CONTRIBUTIONS TO THE INVESTIGATION OF DEVICES FOR TRANSFORMING ROTATIONAL MOTION INTO UNIDIRECTIONAL LINEAR MOTION – elaborated by ing. Attila GERÖCS for obtaining the title of doctor in the field of Mechanical Engineering, I consider that the work is of high scientific level, current, useful, well documented, with original contributions and competently developed. The thesis fulfills all the conditions to constitute a valuable doctoral thesis, for the granting of the title of doctor engineer in the field of MECHANICAL ENGINEERING to the author, ing. Attila GERÖCS.

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dean, head of Department of Technology,
Faculty of Engineering, University of SZEGED, Hungary