Universitatea din Piteşti

HABILITATION THESIS

SUMMARY

ANALYSIS OF THE WEAR DEFECTS OF BEARINGS UNDER SIGNIFICANT DYNAMIC SEVERITY CONDITIONS

Domain: MECHANICAL ENGINEERING

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A. SUMMARY

ANALYSIS OF THE WEAR DEFECTS OF BEARINGS UNDER SIGNIFICANT DYNAMIC SEVERITY CONDITIONS

The Habilitation Thesis is structured along three sections, as follows:
•**B1**–Scientific and professional achievements
•**B2**–Plans of career evolution and development
•**B3**–Bibliography

B1–SCIENTIFIC AND PROFESSIONAL ACHIEVEMENTS

The thesis represents a continuation of the studies and research started seven years ago in the field of rolling contact, with and without friction between the bearing ball and the rolling paths at small—sized bearings, finalised in a first stage by the PhD Thesis presented at the University "Eftimie Murgu"of Reşița.

In the second stage of theoretic and experimental research it was approached another category of rolling bodies, namely„rollers/ rolls". On this very topic of point contact and linear contact the Habilitation Thesis was finalised, structured in 5 distinct chapters. 242 scientific works of relevance have been consulted, elaborated by romanian and foreign authors.

Chapter1 Bearings specific issues. The thesis proceeded to a classification of bearings and presented the main types encountered in heavy industry, machine-building industry,transportation etc. Using Hertz's relations a study of the contact pressure for ball bearings with the ball diameter D=12,7 has been approached.

Chapter2 Defects occurred in rolling bodies. The technological process of rolls together with the defects that may occur during manufacturing was presented. Afterwards several types of defects and the causes that may result during exploitation, as well as their remedying were shown.

Chapter3. Theoretic research on the wear and tear of radial bearings at rolling contact. Researches are conducted in relation with the elastic bodies contact (Hertz's theory) and at rolling contact with adherence and slide. Particular features regarding the influence of surface quality on rolling contact, analysing the causes of wear and tear during bearings exploitation were presented. Several observations upon the elasto-hydro-dynamic regime are made. It is shown that the main cause of degradation is fatigue at the rolling contact. It was analysed both the particular features of the fatigue phenomenon aswell as the bearings sustainability criteria. The author proposes a new criterion for the assessment of their life duration.

Chapter4 Experimental research. The author presents several materials for bearings manufacture and two types of testing machines for the fatigue of rolling bodies. A number of 120 balls were tested at fatigue for which a dimensional analysis of the results obtained was performed. Tensometrical measurements on the surface of a semi ball are conducted. A testing machine for noise measurments during exploitation was designed (invention proposal).

Chapter5 Research of rollers collision phenomenon in the manufacture technological process and of contact strain during exploitation. For the modelling of the rollers impact phenomenon during manufacture (for instance head-to-head or head—to-generator collisions) the Solid Works software was used, and the results obtained with MEF were close to the analytical calculus. The state of strains and deformations with the help of the finite elements method for two types of bearings having rollers with and without manufacture defects, stressed at five distinct loading steps was researched. At the end of the five chapters the author presented the main conclusions resulted from the material forwarded in the thesis, especially those related to the influence of defects occurred in the rolling bodies (balls and rollers) during their manufacture or in exploitation, with impact on the bearings life duration. The phenomenon of balls and rollers collision in the plant processing and manufacturing process was studied. They rolling elements practically collide very many times in all the phases of the manufacture process. The collisions provoke the deterioration of surfaces (especially in rollers). By collision, a shock contact stress practically occurs. In points, but especially in the mass of the hit body (in the immediate proximity of the contact) there are von Mises equivalent stresses which occur, higher than the yield point of the rolling bodies materials. For this reason, on the surface of balls and rollers especially micro defects occur, which in exploitation may become a trigger of the occurrence and propagation of fissures. Beside the research conducted on the defects occurring in the rolling bodies in the manufacture and exploitation phase, we conducted several surveys for their reduction and removal.

B2. PLANS OF CAREER EVOLUTION AND DEVELOPMENT

The paper shows the way in which the author valorised the results of the researches presented in the habilitation thesis. The author published, as single author, first author or collaborator, 3 monographs, 3 didactic books and 35 scientific papers in specialised journals in the country and abroad, of which 8 ISI-quoted. The author presents the professional experience acquired, the model of activity in the future academic career, the way it will take place and the development directions in the scientific research activity and in the manner of guiding the students as PhD tutor. As for the professional development in the field of scientific research, several priority topics are mentioned. A review of the activity of scientific research and of elaborating monographs, didactic manuals and scientific papers written as single author, first author or collaborator is presented. In the end the author presents the general and major goals of the didactic career development at the University "Eftimie Murgu" of Reşița.

B3. BIBLIOGRAPHY

It contains 242 bibliographic titles of Romanian and foreign authors published after 1976. Among them, a great part are elaborated by the author of the habilitation thesis, either as single author, first author or co-author of 3 monographs, 4 specialised manuals and 35 scientific papers (21 as single or first author), of which 8 are ISI-quoted