Universitatea *Transilvania* din Braşov

HABILITATION THESIS

SUMMARY

Theoretical, simulated and experimental researches in the field of reliability analysis, quality of technological processes and the innovative industrial processes

Domain: Industrial Engineering

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This habilitation thesis contains a summary of the scientific, professional and academic activity made from awarding the title of doctor in December 2005 in Engineering Science, Industrial Engineering field profile.

The PhD thesis theme was a prerequisite for further concerns regarding the reliability of products and processes, which allowed a continuous and sustained improvement. Scientific activity that followed was materialized by studying industrial product reliability, whatever was the industrial domain, aiming to analyze and improve the quality and reliability of products and manufacturing processes.

This paper is divided into two sections: (A) Abstract (B) scientific and professional achievements and future plans for career development, comprising in three parts (B-i) scientific and professional, (B-ii) Evolution plans and career development and (B-iii) References.

In section (B-i) of habilitation thesis are presented succinctly significant scientific contributions related to simulation and reliability analysis of the processing of turning and injection molding for plastic materials, using dedicated software (Weibull ++ Expert Curve, Minitab), parametric estimation of the main indicators of reliability for wind turbine with vertical axis helical type and theoretical and experimental analysis of reliability for towed grader components. Improving the quality and reliability of super finishing processes was made analyzing the potential failure modes by applying specific methods for industrial risks management (FMEA). This method consists of assessing punctual influence of process parameters in order to plan the necessary corrective actions to reduce and control potential failure modes and applying measures to prevent their occurrence.

In Chapter 1 is presented the personal contributions regarding: statistical modeling of manufacturing processes reliability, studies, algorithms and the results achieved in the field of reliability and quality of products and industrial processes, the main reliability indicators being expressed by the defective fraction level. Estimating reliability, respectively non-reliability of turning machining process consists in analyzing the experimental data measured for two dimensional characteristics, determining the values of capability, potentiality indices, indices Taguchi and the defective fraction. It can be concluded that by estimating the reliability of the processing, it can analyze the process not only in terms of variability and average experimental data, but also in terms of estimating the forecasting behavior in time of it, which will allow improving the quality of manufacturing processes, reducing the number of defective products (ppm) and reducing substantial costs of non-quality.

Technological performance of smoothing the surfaces by super finishing regarding the roughness obtained, manufacturing productivity, dimensional and surface geometry accuracy of the piece are influenced by technological factors and by the design of the processing technology system. Therefore, it were analyzed the potential failure modes and effects (FMEA) using risk management method specific to manufacturing processes.

The following study refers to estimation of the reliability of an injection process for flanges of two dimensions considered important in the process of mounting the work piece in the fuel tank. Comparing the results, it can be concluded that the reliability of the manufacturing processes is determined by the most important technological and constructive parameters of the manufacturing system that influence product quality in various conditions.

In Chapter 2 are presented relevant results regarding parametric simulation and estimation of the main indicators of reliability for various industrial products. The first study relates to estimate vertical axis wind turbine reliability of patented helical type for weather conditions in Romania. In order to forecast turbine performance, preliminary simulations were performed regarding the energy supplied daily and annual for different wind speeds. The analysis of experimental results indicate that this vertical axis wind turbine helical type, for low wind speeds, is more efficient than horizontal axis wind turbine equipped with three blades.

The study regarding reliability indices estimation of towed grader attachments it addresses to the experimental validation of the results obtained by finite element analysis (FEA) in accordance with theoretically and experimentally analysis of the reliability indices estimated by least squares method. FEA was conducted to predict the safety factor of the towed grader blades, determining the level of stress and strain and estimating the minimum lifetime. Considering the working data, the duration of exploitation, as well as the constructive and technological factors, the reliability of the front blade, rear blade and towed grader frame can be estimated with good accuracy by means of the three-parameter Weibull distribution. The reliability estimation of these components it was performed by point estimation of the main reliability indices applying the least squares method and determining the minimum lifetime for the front blade, rear blade and towed grader frame. The value of the estimated minimum lifetime for actual operating conditions it is less than the value determined by FEA method. These experimental results indicate that the used assumptions may not fully take into account the complex stress encountered in use.

The main scientific achievements presented in this paper it represents the results obtained during the teaching and researches activities conducted at the Department of Manufacturing Engineering, Faculty of Engineering Technology and Industrial Management from the University "Transilvania" of Brasov, highlighted by the international recognition by publishing articles in prestigious international journals with reference influence score >1 and impact factor, indexed ISI Thomson, in international databases and national or international conferences. Besides teaching, professional skills in scientific research are proved by participation in research teams of grants / international contracts (SEE - EEA Grants; ERASMUS + K1) and national (CNCSIS, CEEX, PNII) as director (2), responsible (1) or member (5), contributing to specific project activities and dissemination of research results. International visibility of research and the impact of the work done are proven citations in the ISI and data base journals, member of the scientific committees of journals and scientific events, organizer and reviewer for international scientific conferences, and awards received for excellence in research to meaningful results published in international prestigious journals.