

MODELAREA ȘI SIMULAREA ANGRENAJELOR CILINDRICE, A UNOR
INTERFEȚE, ȘI CONTACTUL ACESTORA IN APLICAȚII INGINEREȘTI
INDUSTRIALE

MODELING AND SIMULATION OF CYLINDRICAL GEARS, THE INTERFACES,
AND THEIR CONTACT IN INDUSTRIAL ENGINEERING APPLICATIONS

ABSTRACT

The habilitation thesis entitled "Modeling and simulation of cylindrical gears, the interfaces, and their contact in industrial engineering applications ("Modelarea și simularea angrenajelor cilindrice, a unor interfețe, și contactul acestora in aplicații ingineresti industriale") was elaborated in order to obtain the habilitation certificate for coordinating and guiding research activities in Ph.D. thesis in the domain of "Industrial Engineering", This work represents the synthesis of my professional and scientific research results. These results which were obtained along my university carrier, which was developed entire in University POLITEHNICA of Bucharest contains 49 works, 13 books and monographies, 37 papers indexed in international data bases, from which 15 are indexed by ISI Thomson Reuters, conference contributions or that were published in the proceedings of various scientific conferences,6 research grants gained by competitions as director or manager, 13 national or international grants as member of scientific research team . The national and international acknowledge is reflected by invitations as visiting professor, by my affiliation to well-known professional organizations and by the invitations as a reviewer or a member of the scientific committee of conferences and journals.

According to the actual regulations (OMECS no.3121/ 27.01.2015), the thesis is structured in three main parts:

- part A. Scientific, professional and academic achievements,
- part B.: Development plans regarding the evolution of professional career,
- part C.: References

In the part A, the first chapter, *Introduction*, is dedicated to an introduction in my interest domain of scientific activity, modeling of gear transmissions and simulation of elastic contact of interfaces for various industrial applications.. The individual scientific research activity was from the beginning at my professional activity in University Politehnica of Bucharest related to the doctoral program where I worked closely related to the mechanical transmission with gears, the elastic contact of interfaces, modelling and simulation with Computer Aided Design tools. Therefore one of the covered areas results as a continuation of research undertaken in the PhD thesis. The second chapter, *Modeling and generation of geometry spur involute spur gear*, is dedicated to the specific modeling and generation of geometry for spur gear. Aspects concerning my first period of scientific activity, papers and presentations with results of these studies are presented in this part.

In the process of machining a gear blank, but also in process of meshing, the required teeth geometry can be obtained by using the obtained cylindrical and helical gears, whose forms are easily determined by analytical methods, envelope theory or numerical modeling. Here the authors provide geometric modelling of the designed gear teeth meshing when assembly

errors are present involving CAD modeling. To illustrate the effectiveness of the approach, meshing gear process is simulated.

Chapter 3 is dedicated to the *Modeling of elastic contact in meshing process*. Due to the effect of contact forces there occur relevant elastic deformations in the process of gear meshing and it is required for a high quality of the analysis to introduce elasticities in the model. One of difficult part is to describe and implement an algorithm in order to find the effects of multi-tooth contact. Results obtained in my activity in post doctoral period are presented. Some works are related to the collaboration with researchers from University of Poitiers, LMS Angouleme.

Today, a characterization of a surface, at macro and microscale geometry, involve a 3D model and not only a section. In this way can we have a proper statistical interpretation and a determination of parameters that characterize the surface of potential elastic or rigid contact. A surface even after careful alignment, so that data acquisition is made, may have some positioning errors or deviations to take into consideration. This is presented in The Chapter 4, *Characterization and modeling of contact surfaces*. During the period of work as invited professor at Poitiers University (2009), some new and original methods and algorithms were developed concerning the characterization of surfaces. Results, presented in papers, describe a new method to synthesize data in order to create an artificial surface, known roughness average variance, skewness and kurtosis of the surface. We using a PDF, which is a generalization of Gauss PDF (Probability Density Function). This method was used to characterize surfaces for various type of machine elements.

In the last chapter, Chapter 5, *Modeling interfaces and their contact for industrial applications*, is presenting some applications which are linked to the defined fields of interest.

In the last years of scientific work I have been integrated into work teams of the University of Poitiers - P'Prime Institute associated with the University of Poitiers and the National Institute of Applied Sciences, INSA-Rennes, France. In this chapter are presented results concerning the FEA modeling and simulation for applications such as: *friction analysis of reciprocating hydraulic 'U' rod seals, analysis of metallic materials behaviour during severe loadings using a FE modeling of the SHPB test based on a numerical calibration of elastic strains with respect to the raw measurements and on the inverse analysis principle or mechanical test for vapour phase solder joint*.

Most of all papers and presentations are linked with research in the frame of national or international scientific grants. It is mentioned: *Research for the modeling and FEM computer programs to determine the actual load distribution in cylindrical gears and solutions to increase uniform distribution, Theoretical and experimental research to optimize the contact stiffness of parts to increase bearing capacity and reliability, Modernising the research techniques used in the field of the product development, through the use of information technology –MODEPRO, SNF Suisse 062612/2000, Human joint prosthesis bases "Grant nr.33784 / 2002 CNCSIS D118*.

Concerning the activity to coordinate and guide research activities in Ph.D. thesis, in the last five years I was involved in 7 thesis as member or co-director (thesis coordinate by UPB and University of Poitiers) in the guiding teams and in 5 thesis as member of jury for the final thesis presentation.

Part B presents professional development plan outlining career development in teaching and scientific research and the main development directions and activities targeted for the next period of time. It is estimated that will lead to increase visibility and results the applicant's and teamwork scientific activity in University POLITEHNICA of Bucharest.