Universitatea *Transilvania* din Braşov

HABILITATION THESIS

SUMMARY

MECHANICAL SYSTEMS. DESIGN & RESEARCH TOWARDS 20/20/20

Domain: Mechanical Engineering

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Starting with the originality of the contribution brought by the Ph.D. Thesis, defended in year 1999, the present Habilitation Thesis offers an image of the reserches along period 2005-2016.

The scientific research is developed in the frame of the 20/20/20 goals stipulated by the Directive for Energy Eficiency of the European Union (2012/27/UE), imposing the following targets for year 2020:

- 20% reduction (or even more) of CO2 emissions compared to 1990 levels;
- 20% of of final energy consumptions, compared to 2005 levels, by increasing energy efficiency;
- Increase to minimum 20% of the total energy, on the basis of consumption, coming from renewables.

In the same directions have been moved the goals of automotive industry for year 2020. Targets in the equvalent CO2 emissions and fuel economy have been set. American standards CAFE (Corporate Average Fuel Economy) are imposing a one third reduction of fuel consumption, compared to year 2008. European Comission set a goal for 2021 of average CO_2 emissions of 95 grams CO_2 / km for the whole fleet produced in 2020. This means an average fuel consumption of 4.1 l petrol/100 km or 3.6 l Diesel/100 km.

Based on these motivations, the current research is developed on the following three directions:

- Contributions to optimal design of speed multiplicators for wind turbines;
- Contribu"Hons to embodiment design of the tracking systems used for photovoltaic (PV) paltforms;
- Cotributions to experimental and theoretical evaluation of friction losses in chain transmissions.

Chapter I "Research on planetary power transmissions. Ph.D. Thesis" makes a brief presentation of the main contributions of the Ph.D. Thesis, as a way of showing the research ability of the author at that date.

Chapter II "Optimization of speed multiplicators for wind turbines" presents results of research developed on the goal of selecting the optimum solution of speed multiplicator for a given wind turbine. There have been considered the cases of two classes of wind turbines, by their power: small power turbines (double step coaxial or palnetary speed multiplicators) and medium to high power turbines (double step planetary multiplicator, planetary and external cylindrical gear multiplicator and planetary and internal cylindrical gear multiplicator).

The optimisation algorithm is presented, with case studies for selection of the optimal solution based on criteria like minimum radial clearance (G) or minimum volume of material (V), for a an imosed range of multiplication ratios.

Chapter III "Elements of embodiment design of tracking systems" starts by presenting tracking systems for PV platforms and experimental demonstrators, developed with authorôs

contribution and continues with detailing aspect of defining the specific elements of embodiment design for this kind of mobile systems:

- Wind action on the platforms of the tracking systems, for which Eurocode building standards are not giving enough data;
- The load cases created by wind action on tracking systems platform must be defined depending on product design specifications, but mostly by the possible functional positions of the platform and the mechanisms used for tracking.

Chapter IV "Evaluation of friction losses in chain transmissions" reaches theoretical and experimental aspects of determining friction losses in chain transmissions.

The part dedicated to experiments is describing the equipment and devices, specific procedures, testing methodology and results. There are presented result on the measured friction on the bearings of a rig for testing basic chain transmissions, friction in the chain itself, without bearings or guides, but also guide and chain contributions on the global friction, without bearings of a chain working with guide. There are also presented considerations on the measured friction coefficient between chain and guide and on the lubrication regime of chain-guide contact. For all these steps, conclusion and further direction of research are drawn.

This chapter also contains a part dedicated to theoretical approach on friction losses of chain transmissions. There are presented aspects of defining the position of the contact point between the elements of the chain and the sprocket, considering dimensional accuracy, elastic deformation under load and the influence of wear on chain elongation.