CT2M
Center for Mechanical and Materials Technologies

Scientific Interaction Meetings

Meeting nº 2

2007.11.07 – 14-15h

Room: B1.13

Agenda:

14h - Francisco C. P. de Brito, The Role of Lubricant Supply Conditions on the Performance of Twin Groove Journal Bearings: A Theoretical and Experimental Study

14h30 – Fernando Meireles, Kinematic analysis of human locomotion based on experimental data

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The first Scientific Interaction Meetings (SIM) was held on 26th October, initiating an enthusiastic discussion and brainstorming time for all researchers who attended.

Who are we? What are we doing? Which are the main scientific achievements of our work? Which difficulties are we facing during the development of our scientific work? These are the questions we want to raise in the framework of SIM. By joining together most of the CT2M´s researchers in a regular basis (every two weeks), this SIM cycle is also expected to contribute to the promotion of further joint research actions involving different research groups. Your participation will be highly appreciated.

In the second SIM session the following works will be presented:

1.The Role of Lubricant Supply Conditions on the Performance of Twin Groove Journal Bearings: A Theoretical and Experimental Study

By Francisco C. P. de Brito (francisco@dem.uminho.pt)

Abstract: Hydrodynamic journal bearings are deployed in the support of rotating shafts. They are widely used in mechanical systems such as turbines, compressors, gearboxes and pumps, being the only practical option to the designer in cases where shafts are subjected to high velocities and high applied loads. When predicting the performance of journal bearings submitted to severe operating conditions it is vital to take into account thermal effects and the local variation of lubricant temperature and viscosity. The lubricant supply conditions, such as supply pressure, supply temperature and feed groove geometry should be taken into account in the formulation of the theoretical model.

The main goal of this work is the development of a thermohydrodynamic (THD) computational model for the prediction of the performance of twin axial groove journal bearings. It is based

on the simultaneous numerical solution of the Reynolds Equation (which governs lubricant flow), the Energy Equation (which governs heat transfer and generation within the fluid) and the Laplace Equation (which governs heat transfer within the solid bodies). In order to validate and refine the theoretical model a program of experimental tests has been carried out on the rigs of the Solid Mechanics Laboratory (University of Poitiers, France) and of the Machine Elements and Tribology Laboratory (University of Minho). The work is nearly concluded. More detailed information about the work developed may be found in the papers published (https://repositorium.sdum.uminho.pt - search for author F. P. Brito).

2. Kinematic analysis of human locomotion based on experimental data

By Fernando Meireles, (meireles@dem.uminho.pt)

Abstract: A general methodology for kinematic analysis of human locomotion based on experimental data is presented and discussed in this work. The kinematic equations of motion and the human biomodel description are developed by using Cartesian coordinates. The trajectories of the bodies that constitute the biomodel are obtained from experimental data acquisition, in which relevant anatomical points of reference are followed, as they represent the human natural gait motion. These points are typically used to represent the natural joints. After obtaining the data relative to the human gait motion, the points are interpolated in order to define the necessary analytical expressions that represent the guiding constraint equations. These constraints guide all the degrees-of-freedom of the biomodel. In order to describe the constraints in closed-form expressions, cubic interpolation spline functions are used, which consist of polynomial pieces on subintervals, joined together according to certain smoothness conditions.

For this purpose, the degree selected for the polynomial functions is 3, being the resulting splines named cubic splines. The reason for that is due to the fact that the cubic polynomial functions are joined together in such a way that they have continuous first and second order derivatives. Since the constraints are defined, they are implemented in a computational code devoted to the kinematic analysis of multibody systems. As future work, a natural follow-up is to test the methodology proposed with a general gait motion, as well as to include it in a computational code for dynamic analysis of human locomotion. For this to be achieved additional experimental work is required.