SLIDER-CRANK MECHANISM MODELLING WITH CLEARANCE IN PISTON-PIN REVOLUTE JOINT

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This work presents the development of a dynamic model for the slider-crank mechanism with clearance on the piston-pin revolute joint. The equations of motion for this system are obtained by Lagrange's method and the effects related to contact, friction and lubrication at the elements that operate in the clearance are the targets of study.

The contact force model used in this work is based on Hertz formulation, considering the inclusion of the dissipative effect associated with the impact between the pin and the piston. The frictional force adopted is based on the Coulomb friction but adapted to the multibody dynamics approach. Such models are validated with the results found in recent literature.

The research presents contribution in evaluating the effect introduced by hydrodynamic lubrication in the revolute joint clearance. Two models of hydrodynamic lubrication are investigated: the first model presents a direct solution of low computational cost [1], the second model results in a numerical solution that consider the effect of the acceleration of the lubricant fluid imposed on the movement of the mechanism [2].

It was observed that the lubrication model does not guarantee the support of the pin-piston system for hydrodynamic lubrication in the simulations. Based on comparison with previous works [3], the model proposed here is promising to foresee the next steps for reproducing the behavior of the piston-pin contact.

REFERENCES