TECHNISCHE UNIVERSITÄT CHEMNITZ

Standard simulation of a rotating heat pipe

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Description:

Since over thirty years, time integration schemes for mechanical systems are developed, which reproduce belance laws numerically exactly independent of the accuracy of the time discretisation. These time integration schemes are called structure preserving time integration schemes, because the balance laws are considered as structure of the problem. For instance, the balance of momentum, the balance of energy, the balance of entropy as well as important material properties as incompressibility are investigated. The aim was so far the increase of numerical stability and robustness of the time integration, because a physically consistent time stepping scheme much less critically react to dynamical loads and adaptive time step size changes. The quality of a physically consistent numerical solution for a real mechanical system has not been investigated until now. Especially for mechanically coupled problems arising from the consideration of further physical fields, a numerically exact reproduction of balance laws leads to an increase of solution quality.

Aims:

In this work, a simulation of a rotating heat pipe with standard time integration schemes has to be performed. The physical model has to be adapted to the rotating heat pipe test rig of the professorship of applied mechanics/dynamics (TMD). Generally, it has to be investigated the abuse of a standard time integration. But, the very important aspect of this work is the development of an appropriate computational model for the heat pipe test rig, because the corresponding simulation results have to be validated in a subsequent work by measurements. The test rig includes special plain bearings, thermo-mechanical coupling in the pipe material as well as fluid-structure interaction inside and outside the rotating pipe, for instance.

Work programme:

The complexity of the rotating heat pipe model will be increased step by step. First, a free rotation of an isolated thermoelastic heat pipe is simulated. Then, thermal boundary conditions are included. Subsequently, the plain bearings has to be included, and so on. During these simulations, the deformation of the heat pipe and the mechanical loads on the pipe has to be depicted in diagramms.

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