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Flexible bodies with thermoelastic properties in multibody dynamics. In J.M. Goicolea, J. Cuadrado, J.C. García Orden, (eds.): Proc. of Multibody Dynamics 2005 (ECCOMAS Thematic Conference). - Madrid, Spain, 21-24 June, 2005.

Abstract. In flexible multibody dynamics elastic deformations due to thermal expansion are generally omitted since thermal displacements are usually small compared to those caused by mechanical loads. However, if a mechanical process is associated with a substantial heat generation or load, the validity of this approach has to be reviewed. In a wide range of applications such as friction brakes, thermal buckling phenomena, machine tools with thermal loads, micromechanical devices with resistive heating, the heat energy flow and the thermoelastic coupling cannot be ignored.

In order to cope with those applications a consistent theoretical framework is introduced by the present paper that enables a combined thermal and elastic analysis in multibody dynamics. The theory is based on a linear material constitution that is inserted into the weak field equations of a flexible and heat conducting body.

The technical relevance of thermoelastic effects like the Gough–Joule effect, thermoelastic damping and thermally excited wave propagation is reviewed. As a consequence appropriate modelling assumptions can be deduced that enable a low-dimensional formulation of the displacement and temperature field by means of a modal multifield approach.

This approach is applied to a high-performance machine tool with thermal loads caused by linear induction drives.

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