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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, micro-mechanical 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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