An Intrinsic Model for Thermoelastic Thin Shells

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In view of the control of the thermoelastic thin shells, we consider the problem of modeling a dynamic thin shell with thermal effects, using the coordinate-free intrinsic model introduced by Michel Delfour and Jean-Paul Zolésio (5; 4). The aim of this method is to produce a coordinate free version of the shell equations, in contrast to the classical equations which require explicit representation of the nonconstant coefficients. With the intrinsic approach, one can exploit the underlying geometry of the shell to derive equations in which the nonconstant coefficients are written in the form of tangential operators. This enables us to better modify and apply known techniques that were developed for use in the constant-coefficient case (flat plate models).

In previous work (2; 3; 1) we have developed a linear dynamic model of the thin shell and shown several stability/controllability results. However, as thermal effects are very important in many applications of engineering, we wish to include them in our shell model. We proceed in the development of a (linear) thermoelastic shell model based essentially on similar assumptions to those which are used in the derivation of classical linear thermoelastic plate models (see, e.g. (6)).

As such, we subject the elastically and thermally isotropic shell to an unknown temperature distribution. Eventually this yields a fully-coupled system of four linear equations whose variables are the displacement of the shell mid-surface and the thermal stress resultants.

This work continues the development of the model introduced in (7). We will present an improved modeling which improved the way the curvature is taken into account. Wellposedness will be established.

REFERENCES