REU Summer Project Statement

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Numerical validation of reduced models in thermoelasticity.

1 Project Description

Today, more and more sophisticated mathematics is used to model, analyze and simulate dynamical systems arising in a variety of situations.

The study of thermoelastic models is of crucial importance in the design of plane wings and car spoilers, which can be regarded as dynamic thin linearly elastic plates.

The classical three-dimensional thermoelastic models based on the Duhamel-Neumann are not suitable for describing situations where the structure under consideration is made of a non-homogeneous or non-isotropic material. Apart from these mathematical difficulties, it is also well-known that the numerical implementation of three-dimensional models is often affected by locking, which is a major difficulty in scientific computing.

This is why it might be useful to have available suitable *two-dimensional approximate* models that asymptotically behave like the three-dimensional counterparts when the thickness of the plate becomes small.

The objective of the project consists in *testing* - via rigorous numerical simulations based on the Finite Element Method - the effectiveness and genuineness of *ad hoc* two-dimensional approximate models, and *validate* that they asymptotically behave as their three-dimensional counterparts as the thickness approaches zero.

2 Prerequisites

(1) Knowledge of multi-variable calculus;

(2) Knowledge of basic physics;

(3) Some exposure to PDEs;

(4) Proficiency in the Python programming language.