Validation of models that predict the performance of aerospace engine materials depends on the ability to obtain accurate single crystal elastic constants. Resonance Ultrasound Spectroscopy (RUS) is a nondestructive technique in which the natural resonances of a material are utilized to obtain these constants. Traditional RUS utilizes an analytic approach to determine the resonance frequencies of a specimen given an initial guess set of elastic constants. A nonlinear optimization process then fits the elastic constants to experimentally measured data. This approach is limited both in its ability to handle specimens with complex geometry and to handle polycrystalline materials. These more complex scenarios can be approached by utilizing a finite element forward model to obtain sample resonances.

A finite element forward model is being developed utilizing COMSOL Multiphysics to compute specimen resonance frequencies. Elastic constants are obtained utilizing a bounded nonlinear optimization routine in MATLAB by way of COMSOL's LiveLink for MATLAB interface. Validation of this forward model has been performed on single crystal specimens, including a nickel superalloy parallelepiped and a fused silica cylinder with a chamfer, ultimately producing lower residual error after optimization than the traditional RUS approach. Model validation is also being performed on a Nickel Aluminide (NiAl) bicrystal. This paper presents the details of this validation process. Also presented is an examination of error sources and the impact they can play in the ability to accurately obtain elastic constants.

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