MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

DEPARTMENT OF CONSTRUCTION SCIENCES | FACULTY OF ENGINEERING LTH | LUND UNIVERSITY

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PRESENTATION

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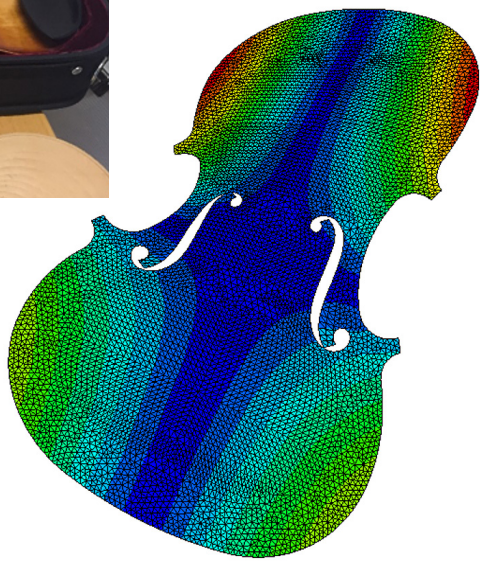
MEASURING AND FE-MODELLING THE DYNAMIC CHARACTERISTICS OF A VIOLIN



BACKGROUND

The Stradivari violins are regarded as the finest in the world. The geometric shape of these violins were unique and some of its features will be studied in the Master's thesis. The sound of a violin is produced by vibrations from the strings that are transmitted to the top plate and bottom plate through the bridge. The plates reverberate within the hollow body, producing the tone characteristic of the violin. The prestress from the violin strings and the anisotropy of the wooden material will over time change the geometry of the violin. The geometric shape of the violin and the material properties have a large influence on the eigenmodes and resonance frequencies, which in turn determines the harmonic content that gives the violin its unique voice.

OBJECTIVE

The aim is to develop numerical models of a violin that can be used for examining the influence of the shape of a violin on its tonal qualities, primarily in terms of harmonic content. If any property of the Stradivarius violin yields unique acoustic properties it should also be examined. Geometric shape, stiffness and time dependent phenomena such as material creep are, among others, parameters which will influence the dynamic properties of the violin that will be examined.

METHOD

In this Master's thesis the influence of the geometric shape on the harmonic content will be examined by modelling a violin and performing a finite element (FE) analysis. The analysis will be based on structural dynamic analysis, the FE method, experimental modal analysis and material science in the context of wood structures. Dynamic FE models of parts of a violin will be developed using Abaqus. The geometry will be created from CAD models of shapes measured from real violins. Experimental dynamics analysis will be performed using violin parts provided by Robert Zuger, violin maker and designer. The FE-models will then be calibrated from the measured dynamic properties of the individual parts. In addition, numerical parameter studies will be performed.

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