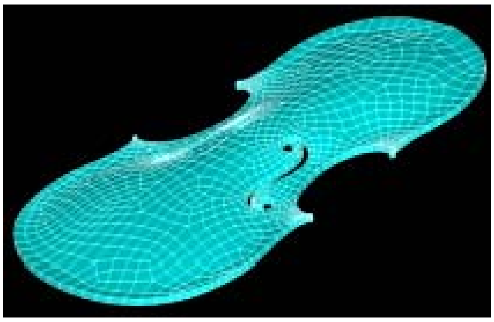
Vibroacoustical analysis of violins

VIOLINS belong to the most complex structures among musical instruments. Many individual components interact in a violin as a system of coupled substructures. Tradition and centuries of experience in this craftwork are still the basis for violin makers to decide about many parameters that have influence on the quality of a violin. Numerical models that allow the analysis and simulation of the vibro-acoustical behaviour of a violin may support a better understanding of the function and influence of the determining parameters.



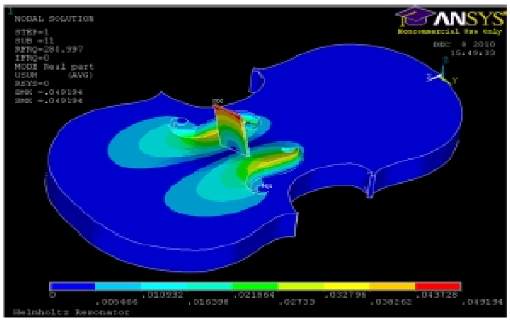


Figure: Model of the violin’s top plate (left) and Helmholtz frequency analysis (right)

Due to the complexity of a violin model, small changes in geometry, material properties or boundary conditions may have a significant influence on the physical measures like modeshapes, modal density or the sound power, radiated for different frequencies. These measures on the other hand have a direct effect on the acoustical parameters like e.g. the tonal color.

In this project the influence of changing geometrical or material parameters are studied for an existing violin model. The project includes the modelling and automation of the workflow that is necessary to simulate the dynamical and acoustical response of the violin with changeable parameters.

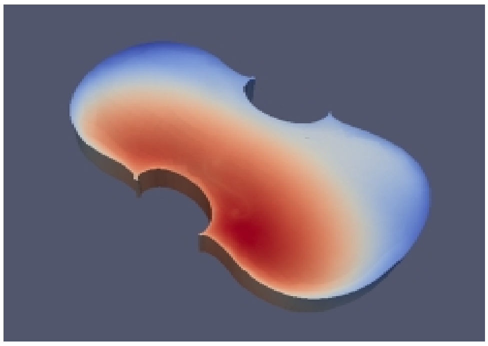


Figure: sound radiation field

Supervisors

Martin Buchschmid, Johannes Kreutz, Lehrstuhl für Baumechanik
Martin Ruess, Chair of Computation in Engineering

References

[1] Neville H. Fletcher, The Physics of Musical Instruments, Springer, 2008