Modeling, identification, and optimization of violin bridges

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A violin bridge is a slender piece of wood which has a decisive influence on the acoustics of the whole instrument [4]. Therefore, it is our goal to optimize the bridge with respect to its material parameters and its shape. The simulations for this are based on an isogeometric multi-patch geometry, see Figure 1, where we couple the patches weakly by means of mortar methods [1], [2]. This gives us a flexible and accurate approach without any restrictive demands on the interface meshes.

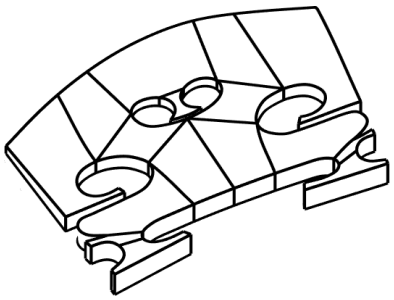

Figure 1: Patchdecomposition of the violin bridge

A crucial point for successful and accurate computations is the assembly of a realistic NURBS geometry. To achieve this goal, we construct the B-splines of our geometry with a non-linear least squares fit to data gained from a μ-CT scan of the bridge, modifiying a method suggested in [3]. Based on this new 3D-geometry we solve the eigenvalue problem of elasticity for the orthotropic material law of the wooden bridge and implement simulations for its dynamical behaviour. Furthermore, we determine material parameters by solving an inverse problem based on actual admittance measurements and identify sensitivities of the solution with respect to shape and material parameters.

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