ENERGY BASED SIMULATION OF A TIMOSHENKO BEAM IN NON-FORCED ROTATION. INFLUENCE OF THE PIANO HAMMER SHANK FLEXIBILITY ON THE SOUND.

Juliette Chabassier[1], *Marc Duruflé*[2]
[1] Modartt, France
[2] Inria, France
juliette.chabassier@pianoteq.com
marc.durufle@inria.fr

ABSTRACT

A nonlinear model for a vibrating Timoshenko beam in non-forced unknown rotation is derived from the virtual work principle applied to a system of beam with mass at the end. The system represents a piano hammer shank coupled to a hammer head. An energy-based numerical scheme is then provided, obtained by non classical approaches. A major difficulty for time discretisation comes from the nonlinear behavior of the kinetic energy of the system. This new numerical scheme is then coupled to a global energy-preserving numerical solution for the whole piano. The obtained numerical simulations show that the pianistic touch clearly influences the spectrum of the piano sound of equally loud isolated notes. These differences do not come from a possible shock excitation on the structure, nor from a changing impact point, nor a "longitudinal rubbing motion" on the string, since neither of these features are modeled in our study.