

ACOUSTICS2008/893
Control parameters of a generalized vibrato model with modulations of harmonics and residual

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Our previous research focused on vibrato modeling of the harmonics of musical sounds. We demonstrated the need to account for fundamental frequency modulation, global amplitude modulation, but also spectral envelope modulation linked to brightness modulations. This may result from non-linearities between the excitation signal and the resonating body, and/or from variable spectral sampling of the impedance function as F_0 varies. For instance on flute, vibrato results from air pressure modulations.

We also observed in sounds with vibrato of wind instruments that the residual also exhibits amplitude modulation, somehow due to air pressure modulations that are responsible for vibrato. In a pilot listening test on shakuhachi sounds (for which the residual is obviously modulated), we asked participants to discriminate between the original modulated harmonics plus the amplitude modulated residual, and the original modulated harmonics plus a non-modulated residual, in a AB comparison task (same/different test). Preliminary results show that participants can hear the difference, suggesting that the amplitude modulation on the residual is audible. Subsequently, we developed a generalized vibrato model incorporating modulations on harmonics and residual. This model is presented here with an emphasis on its control parameters.