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A numerical study of self-sustained oscillations in wind instruments[1] PABLO L. RENDON, ROBERTO VELASCO-SEGURA, Univ Nacl Autonoma de Mexico — The study of sustained notes in wind musical instruments in realistic conditions requires consideration of both excitation and propagation mechanisms, and the manner in which these two interact. Further, to model adequately acoustic propagation inside the instrument, a variety of competing effects must be taken into account, such as nonlinearity, thermoviscous attenuation and radiation at the open end. Physical solutions also involve some degree of feedback at the excitation end, and here we propose the simplest boundary conditions possible at this end, given by a simple harmonic oscillator with fixed stiffness. By feeding single-frequency acoustic waves into the system we are able to study the formation of self-sustained oscillations, which are stationary states associated with resonance frequencies, and also to observe transitory states. Visualizations are presented of waves traveling in both directions. As expected, resonance frequencies are dependent on the stiffness parameter, and this dependence is examined. The full-wave simulation is performed in the time domain over a 2D spatial domain assuming axial symmetry, and it is based on a previously validated open source code, using a finite volume method (FiVoNAGI) implemented in a GPU [Velasco-Segura Rendn, 2015].

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Pablo L. Rendon
Univ Nacl Autonoma de Mexico

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