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Nonlinear effects in standing-wave types of thermoacoustic devices

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In order to create high amplitudes (p'/p_0>10%) for a relatively low frequency range (between 5 and 125 Hz), a large subwoofer is connected to a resonator tube by an exponential horn. A parallel-plate stack, with various plate thicknesses and separations, can be placed at different positions in the resonator tube. The position of the subwoofer membrane, the voltage and current of the subwoofer, as well as the pressure at six different positions in the resonator is measured. The measurements are in good agreement with simulations. Using a multi-microphone method the transfer matrix of a stack is determined experimentally. Using a PIV method a 2-D velocity field between and around the stack plates is measured. The vortex shedding at the end of stack plates is studied in particular. The amplitude, frequency, plate thickness, plate separation and plate-ending shape are varied. Also the streaming velocity field is studied. Small asymmetries in the geometry have a huge influence on the streaming velocity.