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Experimental study of the thermoacoustic effect using infrared thermography

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The thermal metrology used to study experimentally the thermoacoustic effect is almost always based on thermoelectric junctions. This kind of measurement is intrusive and provides a few information in space. This paper presents an experimental set-up where temperature measurement on the thermoacoustic stack is acquired by infrared thermography. This measurement provides more information in space and time to study complex physical phenomena, such as heat transfer through both ends of the stack, non linear edge effects, or optimal spacing between stack and heat exchangers.
The experimental set-up consists of a half-wavelength resonator with a square cross section closed by a rigid wall at one end and coupled to an electrodynamic loudspeaker at the other end. The thermoacoustic core is either a single plate or a stack of parallel plates made of Kapton. Temperature measurements are carried out along the stack by the use of an infrared camera. The acoustic pressure is measured by a microphone flush-mounted on the wall at the exit of the resonator. First results show the essential role played by the edge effects and the heat generated by viscous losses.