ACOUSTICS2008/3100
transition to turbulence and acoustic Rayleigh streaming in thermoacoustic devices

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Thermoacoustic engines and refrigerators with practical levels of heating or pumping power must generally operate at high pressure amplitudes. When used to describe the behavior of such high-amplitude thermoacoustic devices, the well-established foundations of thermoacoustics, based on the acoustic approximation, reach their limits. It is necessary to gain a deeper understanding of the high-amplitude phenomena in order to improve the performances of thermoacoustic devices, and efforts of several research groups have been directed towards this goal over the last decade. In this presentation, we will consider recent advances in the understanding of some of the gas-dynamics phenomena leading to limitation of devices performances, namely transition to turbulence and acoustic Rayleigh streaming. The common point for these phenomena is that they owe their origin in the dynamic of oscillating flows in very near wall regions, so that their quantification implies measurements of acoustic particle velocity in adverse conditions. Recent progresses in Laser techniques used to perform such measurements will therefore also be reviewed.