Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Numerical analysis of a fluidic oscillator STEFAN HOETTGES, TORSTEN SCHENKEL, HERBERT OERTEL, Institute of Fluid Mechanics, Karlsruhe Institute of Technology (KIT) — The technology of fluid logic or fluidic has its origins in 1959 when scientists were looking for alternatives to electronics to realize measuring or automatic control tasks. In recent years interest in fluidic components has been renewed. Possible applications of fluidic oscillators have been tested in flow control, to reduce or eliminate separation regions, to avoid resonance noise in the flow past cavities, to improve combustion processes or for efficient cooling of turbine blades or electronic components. The oscillatory motion of the jet is achieved only by suitable shaping of the nozzle geometry and fluid-dynamic interactions, hence no moving components or external sources of energy are necessary. Therefore fluidic oscillators can be used in extreme environmental conditions, such as high temperatures, aggressive media or within electromagnetic fields. In the present study the working principle of the fluidic oscillator has been identified using three-dimensional unsteady RANS simulations and stability analysis. The numerical models used have been validated successfully against experimental data. Furthermore the effects of changes in inlet velocity, geometry and working fluid on the oscillation frequency have been investigated. Based on the results a new dimensionless number has been derived in order to characterize the unsteady behavior of the fluidic oscillator.

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Date submitted: 05 Aug 2010 Electronic form version 1.4