Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

A Detailed Analysis of Nonlinear Interaction of Cavity Tones in Shallow Subsonic Resonant Cavity Flows M. SAMIMY, J. MALONE[1], M. DEBIASI[2], J. LITTLE, The Ohio State University — The Rossiter equation and its derivatives with two empirical parameters have been used over several decades to understand and interpret shallow cavity tones. A recently developed alternative approach based on signal processing theory interprets the Rossiter equation as the result of an amplitude modulation process between a fundamental aeroacoustic loop frequency and a modulating lower frequency. We present the results of this approach applied to detailed, high quality spectral data of shallow-cavity flows over Mach number range of 0.2 to 0.65. The results show that the spectra can be grouped into several ranges of Mach number with similar behavior, separated by transitional regions. Clear identification of all the tones observed in these spectra validates the ability of the new approach in explaining the complex spectral features of this type of flow. The asymptotic growth with Mach number of the fundamental aeroacoustic loop frequency and the relatively constant modulating frequency provide insight into the variation of the Rossiter mode parameters. The results also indicate that the empirical parameters in the Rossiter equation vary slightly with Mach number for fixed cavity geometry.

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Date submitted: 24 Jul 2008 Electronic form version 1.4