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# Another Look at Supersonic Cavity Flows and Their Control

Ning. Zhuang*, Farrukh. S. Alvi† and Chiang. Shih‡
*Florida A & M University and Florida State University,*
*2525 Pottsdamer St, Tallahassee, FL 32310*

**A Mach 2 supersonic cavity flow, with *L/D* between 1 and 5, was investigated with velocity field measurements, acoustic/unsteady pressure measurements and flow visualization. The evolution in the flowfield between deep (L/D=1) and relatively shallow (L/D~5) was examined both in terms of mean and unsteady *L/D* flow properties. By implementing microjet-based actuators, the flow induced resonance and the accompanying high unsteady pressure loads inside the cavity are significantly reduced, both in terms of the overall sound pressure level (OASPL) and the dominant cavity tone. The required mass flux of the microjet actuator is very low, depends on the *L/D*: $B_c$ between 0.1% to 0.5% is sufficient for 5 to 11 dB reduction in OASPL and 13 to 28 dB on dominant cavity tones.**

## Nomenclature

| | | |
|---|---|---|
| $B_c$ | = | cavity blowing coefficient |
| $D$ | = | depth of the cavity |
| $L$ | = | length of the cavity |
| $M$ | = | Mach number |
| $P_j$ | = | stagnation pressure of microjets |
| $P_\infty$ | = | static pressure of freestream |
| $St$ | = | Strouhal number |
| $U_\infty$ | = | freestream velocity |
| $W$ | = | width of the cavity |

## I Introduction

The study of supersonic cavity flows is of interest both from fundamental fluid dynamics and practical perspectives. The complex nature of this flowfield, consisting of compressible shear layers, compression/expansion waves and fluid-acoustic interactions, makes it a rich problem to study for fluid dynamicists. It is of interest from a practical standpoint due to its presence in many practical flows, such as in aircraft landing gear bays and internal weapon bays. Consequently, research on cavity flow has been ongoing for a number of decades. Some of the first detailed studies were conducted in the 1950's by Roshko[1] and Krishnamurty[2]. In the early sixties, Rossitor[3] developed an empirical equation to predict resonant frequencies based on the feedback mechanism. Heller[4,5] conducted experiments ranging from M=0.2 to 3 and refined Rossitor's equation. This form of the equation is shown below as equation, 1. Bauer and

* Graduate Research Assistant, Department of Mechanical Engineering, Student Member of AIAA.
† Associate Professor, Department of Mechanical Engineering, Member of AIAA.
‡ Chair and Professor, Department of Mechanical Engineering, Associate Fellow of AIAA.