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Boundary Layer Penetration of AFC devices and the Advantages of Combustion.

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Introduction

Active Flow Control (AFC) devices comprise of numerous type of actuators ranging from steady/unsteady compressed air jets, piezo electric actuators, plasma actuators, combustion driven jets, and more. Their primary objective is to deliver sufficient kinetic energy to penetrate a separated boundary layer and either reduce or eliminate flow separation resulting in lower drag coefficients. Several technologies have demonstrated positive flow control metrics (e.g. jet velocity ratio, momentum coefficient) and several have shown promise in experimental flow control studies. However, large Re number flows present a major obstacle due to their inherent high kinetic energy. This work aims to assess the potential performance of miniature combustion driven actuators and determine their suitability for performing in high Re number flows relative to other devices.

Methods

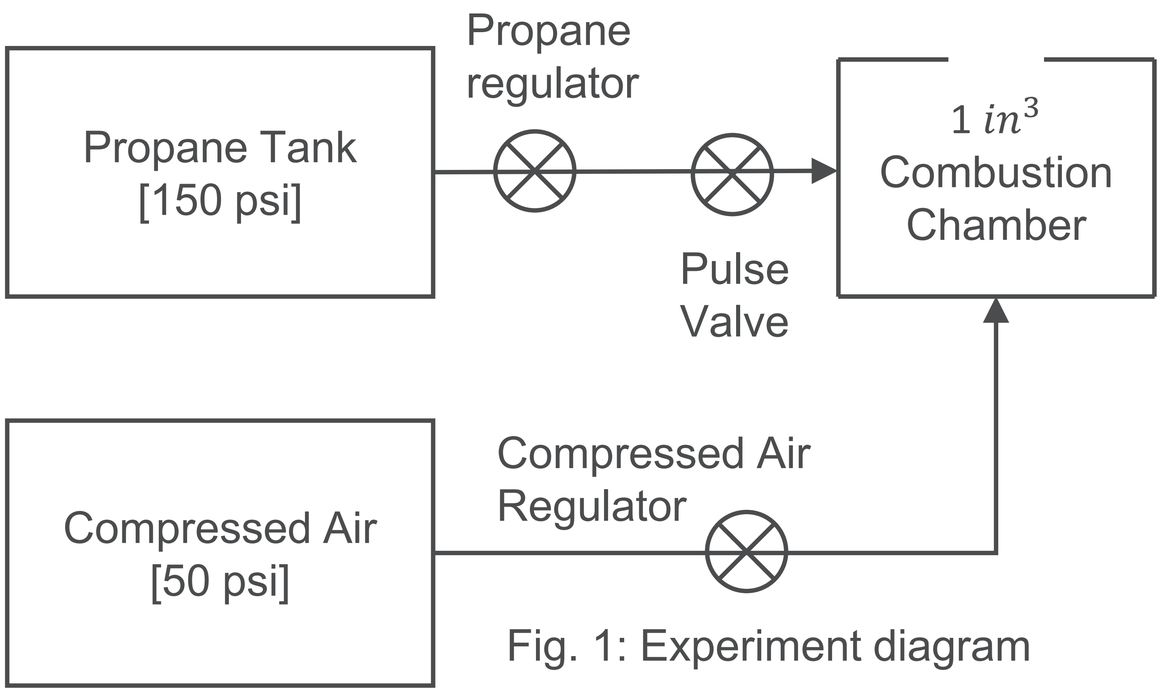

Fig. 1: Experiment diagram

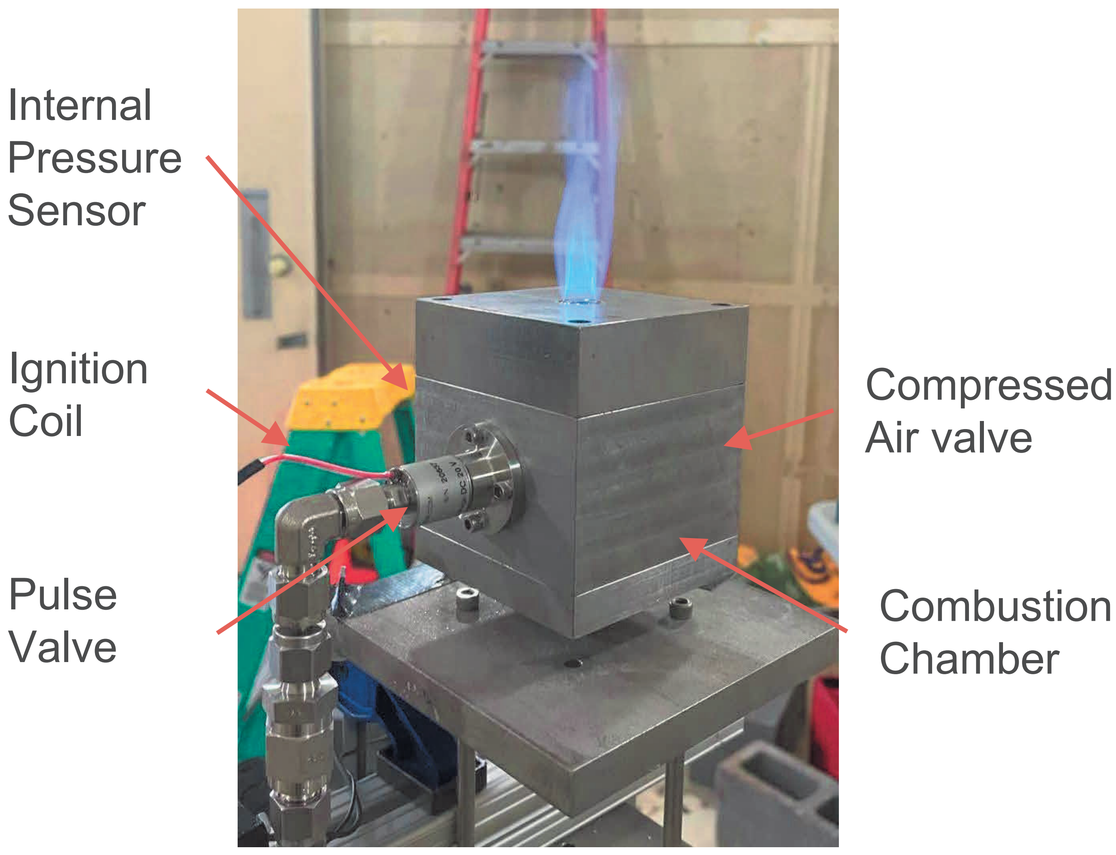

Fig. 2: Experiment Setup

Discussion/Results

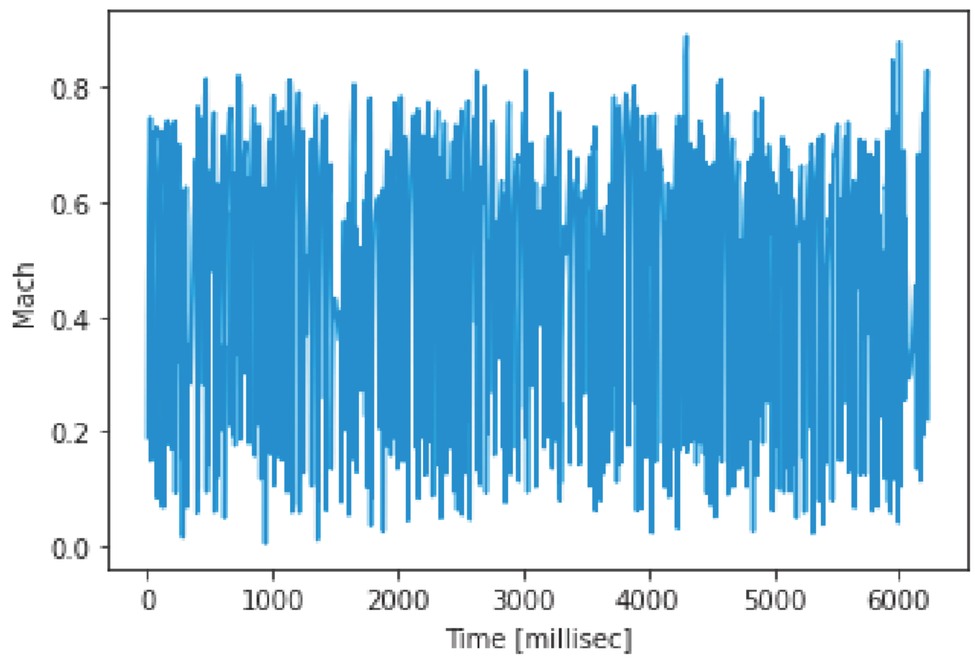

Fig. 3: Mach Number of Combustion-Act

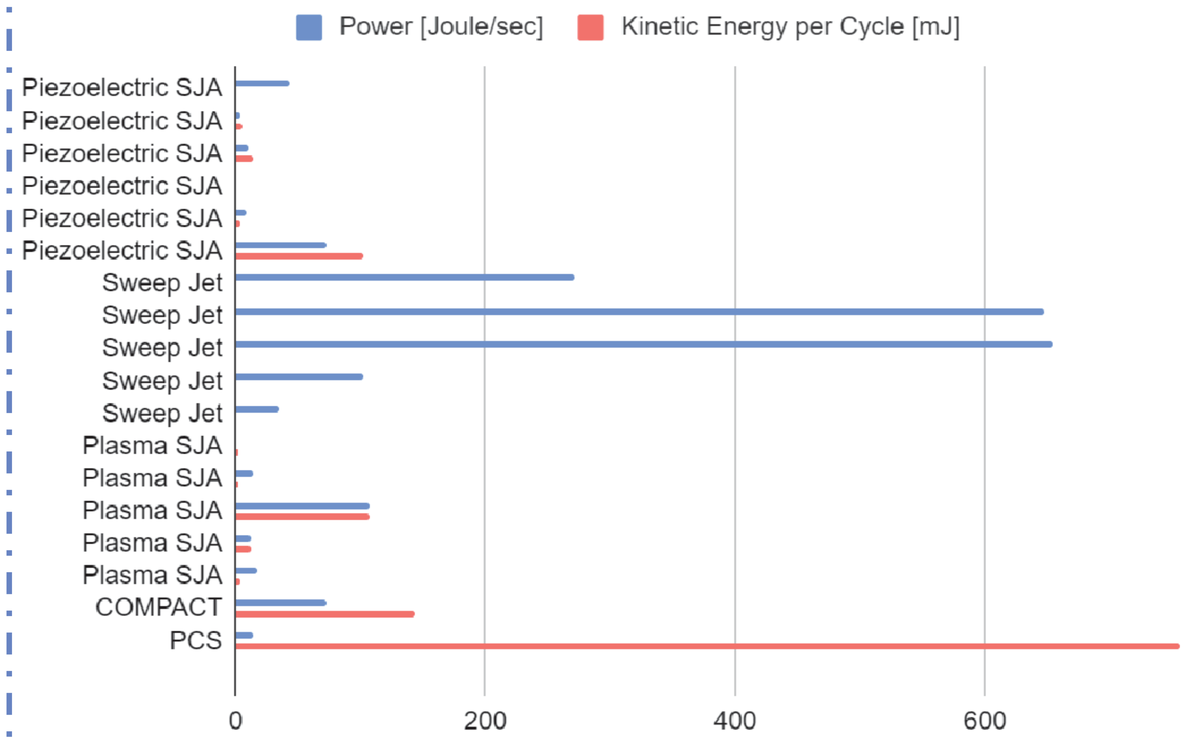

Fig. 4: Comparison of Flow Control Power and K.E

Conclusions

Combustion based flow control methods have the potential to deliver higher Kinetic Energy per actuation cycle relative to other flow control methods. Researchers are miniaturizing this device and working on improving control over combustor characteristics such as operation frequency and power efficiency for future analysis.