The Control of Fluidic Devices for Sustainable Aviation

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Abstract:

Fluidic devices are a family of valves with no moving parts that can be used to control fluid flows. Their applications in aerospace include the control of aerodynamics and the modulation of fuel and cooling flows. Controlling these valves to achieve sufficient authority, bandwidth, and robustness to disturbances is one of the major obstacles to their use. The canonical fluidic valve is the bistable diverter. I will discuss how acoustic excitation can be used for actuation and how the core element of the device – the reattaching jet – responds to perturbations. Concepts borrowed from control and signal processing can be applied to understand the physics of this system, offering insight and allowing performance limits to be defined. Finally, I will discuss the challenge of controller design for this device, which is representative of the broader class of fluid systems.