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Zero-Net Mass-Flux Actuator Cavity Vortex[1] MICHAEL KRIEG, KAMRAN MOHSENI, University of Florida — Zero-Net Mass-Flux (ZNMT) devices are used commonly as synthetic jet actuators for flow control in various applications. The authors have recently proposed using larger ZNMF jet actuators for underwater propulsion; similar to squid and jellyfish. Generally the external flow generated by these devices is characterized according to momentum and energy transfer rates, and little attention is paid to the dynamics of flow inside the cavity. In fact the flow inside the cavity, especially during the refilling phase is not only highly dynamic but greatly influences the pressure distribution at the opening as well as the external flow during the following jetting phase. A completely transparent axisymmetric ZNMF cavity was constructed in order to investigate the internal vortex dynamics. The flow is seeded with reflective particles and illumined with a laser sheet bisecting the axis of symmetry. Standard 2D DPIV techniques are used to recover the velocity field in this cross section. During filling it is observed that a starting jet extending from the opening to the inside of the cavity rolls into a vortex ring much like the jetting phase. However, the effect of the cavity walls becomes apparent almost immediately. In this talk we characterize how the circulation within the cavity decays as a function of both cavity/orifice geometry and the mass flux program. In addition a load cell measures the total thrust acting on the device which is used to validate pressure calculations performed on the moving surface inside the cavity, showing excellent agreement.

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