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Particle image velocimetry and thrust of flagellar micro propulsion systems UMIT DANIS, METIN SITTI, Mechanical Engineering Department, KEREM PEKKAN, Biomedical Engineering Department — Miniature smart devices and micro-swimming robots that can perform in vivo interventions and diagnostic procedures inside the human body require efficient low Re number propulsions systems. A static test-bench to acquire simultaneous thrust and 3D velocity measurements of flagellar micro-propulsion systems is developed. Validation experiments of this set-up involving full computational fluid dynamics (CFD) solutions and approximate Resistive Force Theory (RFT) comparisons at variable rotational speeds (5-13 Hz) and for two different parametric thruster configurations are performed up to Re=0.1. 3D velocity fields are obtained with both side view and bottom view PIV configurations are evaluated for the single helix flagellar thruster configuration. To calculate the control volume thrust 20 PIV slices (acquired by 18 degrees shift of the encoder trigger signal) are interpolated on a cylindrical volumetric grid. CFD studies are in progress. A comparison between PIV results, thrust-cell measurements and RFT theory indicated high sensitivity on RFT drag coefficients. In future studies this measurement protocol will be applied to alternative and non-conventional bio-inspired thruster-configurations.

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