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Bending Stiffness and Critical Forces for Polymorphic Transformations of Salmonella Flagella Measured in a Microfluidic Channel HOSSEIN MOGHIMIFAM, Department of Mechanical Engineering, University of Utah, JAMEL ALI, Department of Chemical and Biomedical Engineering, FAMU-FSU College of Engineering, MEHDI JABBARZADEH, Department of Mechanical Engineering, University of Utah, MINJUN KIM, Department of Mechanical Engineering, Southern Methodist University, HENRY C FU, Department of Mechanical Engineering, University of Utah — Bacterial flagella have been shown to reversibly switch between different polymorphic forms under external forces. We present experiments on *Salmonella* flagella tethered to the surface of a microfluidic channel that measure the flagellar bending stiffness and the critical force required to transform between coiled and normal forms. The near-wall shear flow exerts forces on the flagella and elastically stretches them, and when strong enough triggers polymorphic transformations. We developed a method to reconstruct the 3D geometry of a bacterial flagellum from fluorescent microscopy images with sub-pixel accuracy. The flagellar geometry is specified as a helix with pitch, radius, and axis direction that vary along its length. The expected image of the geometry is generated using point spread function. For each flow rate, we find the best-fit flagellar geometry by minimizing the pixel-to-pixel intensity difference between the generated and the microscopic image using a genetic algorithm. From the geometry of the flagellum and the known flow in the microchannel, we determined the forces on the flagellum using a boundary element method and found the critical force that caused the transformation. We also use a Kirchoff rod model to find the bending stiffness of the flagellum.

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