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A Fluid-solid Numerical Model for the Analysis of Bio-inspired UUV SANTANU MITRA, Virginia Tech, NAGENDRA KRISHNAMURTHY, DANESH TAFTI, Mechanical Engineering Department, Virginia Tech, SHASHANK PRIYA, Bio-Inspired Materials and Devices Laboratory (BMDL), Centre for Energy Harvesting Materials and Systems (CEHMS), Virginia Tech, VA - 24060 — Bio-inspired Unmanned Underwater Vehicles (UUVs) have potential applications for surveillance, monitoring climate change, magnetic field pattern, and migration of species. In past few years, several underwater organisms have been utilized as a source of inspiration for developing new generation of UUVs such as Mantra Ray, Squids, Dolphins and Jellyfish. In our research, we have utilized rowing form of jellyfish as a bio-inspiration and focused our attention on understanding the propulsion mechanism of medium to large diameter ($\sim$40-50 in) species. The motion of the jellyfish results a two-way coupled fluid-solid interaction problem. We provide new types of forcing functions in our model for actuating artificial jellyfish nodes employing flexible muscles such as SMA to make it energy efficient. The present simulation method uses 2-D fluid elements in the framework of the N-S based Immersed Boundary Method (IBM) and loosely coupled plane strain hyperelastic structural elements. This study will be useful in the accurate calculation of pressure distribution on the submerged autonomous vehicle and evaluation of maximum blocking stress in order to design novel actuator systems in terms of energy efficiency. Preliminary work towards achieving these final objectives will be presented.

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