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A bioinspired aquatic robot propelled by an internal rotor PHANINDRA TALLAPRAGADA, BEAU POLLARD, Clemson University — Low dimensional models of fish-like swimming of a deformable Joukowski foil shedding singular distributions of vorticity have been well known for two decades. The deformation of the foil can be interpreted to be periodic changes in an abstract shape space and the creation of vorticity can be shown to act as a nonholonomic constraint. With this geometric insight, it can be demonstrated that a Joukowski foil (or in general any body) can possibly swim to the motion of an internal rotor, that acts as a shape variable. The motion of the rotor pumps in angular momentum and the simultaneous creation of vorticity allows this to be 'converted' into linear momentum of the foil. We demonstrate the feasibility of this theoretical prediction with a robot shaped as a Joukowski foil propelled by the motion of an internal momentum wheel. We also demonstrate that the internal rotor acts both as a means of propulsion as well as a means of controlling the heading of the robot. Some maneuvers of the robot and features of its physical and 'mathematical' resemblance to fish-like motion are demonstrated.

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