

Microbial-powered artificial muscles for autonomous robots

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Abstract — We consider the embodiment of a microbial fuel cell using artificial muscle actuators. The microbial fuel cell digests organic matter and generates electricity. This energy is stored in a capacitor bank until it is switched to power one of two complimentary artificial muscle technologies: the dielectric elastomer actuator and the ionic-polymer metal composite. We study the ability of the fuel cell to generate useful actuation and consider appropriate configurations to maximally exploit both of these artificial muscle technologies. A prototype artificial sphincter is implemented using a dielectric elastomer actuator. Stirrer and cilia mechanisms motivate experimentation using ionic polymer metal composite actuators. The ability of the fuel cell to drive both of these technologies opens up new possibilities for truly biomimetic soft artificial robotic organisms.

Keywords— EcoBot, Artificial Muscles, Dielectric Elastomer Actuator, Ionic Polymer Metal Composite