Biomimetic Mobile Robots at Small Scale

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Abstract- Nature has provided plenty of excellent samples to inspire the design of locomotion mechanisms both in macro and micro scales. Mimicking their propulsive mechanism or structure characteristics could benefit advancement of the mobile robots in diversity, agility and efficiency. Advanced manufacturing technologies has made it possible to fabricate miniaturized machines or scale macro biomimetic locomotion into small scale. In this workshop, we will present several micro biomimetic mobile robots with investigation of their locomotion mechanisms and motion performance in small scale. The proposed microrobots, including a fish-like magnetically propelled microswimmer, a dual-fin microswimmer combined with micromachines, and a microwalker featured with biomimetic structure, are all fabricated by 3D laser lithography. The fish-like microswimmer consists of a head and a caudal fin, with a joint connecting between them. The caudal fin, which is deposited with a layer of nickel, can be controlled to flap by applying an oscillating uniform magnetic field. The dual-fin microswimmer, which is equipped with symmetric dual caudal fins, contains gears to realize the reciprocal and high-precision synchronous motion. The biomimetic structured microwalker can be easily controlled to move on substrate under external magnetic actuation. All these proposed microrobots have exhibited great potential to many biomedical applications such as minimally invasive diagnosis, tissue engineering and in-vivo sensing.