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DASH: A Resilient High-Speed 15g Hexapedal Robot

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Abstract*—DASH, or the Dynamic Autonomous Sprawled Hexapod, is a small, high-power density, minimally actuated robot capable of high-speed running and surviving large falls. The design of DASH has been informed by the study of nature's greatest runners from whom scientists have derived many models for robust high-speed locomotion. DASH is constructed using a scaled Smart Composite Manufacturing (SCM) process which creates rigid cardboard beams with flexible polymer joints that can be folded into complex functional elements. DASH utilizes an alternating tripod gait, and the mechanism by which it creates an alternating tripod gait from a single DC motor is presented. DASH is 10 cm long, has a mass of 16.2 grams, and is capable of running straight at speeds of 1.5 m/s, or 15 body-lengths per second, which is as fast as other similar legged runners in body-lengths per second. Both real time and slow-motion video of high-speed running are shown. A lightweight servomotor can modify the kinematics of DASH so that turning moments are generated. The cardboard beams from which DASH is constructed are rigid in directions which allow for sufficient power transmission for high-speed running. The beams are also flexible but resilient to off-aixs forces and moments which allow DASH to contort and absorb energy under forces not normally seen during running. This property helps to enable DASH survive large falls without damage, including drops from 28 meters onto concrete.

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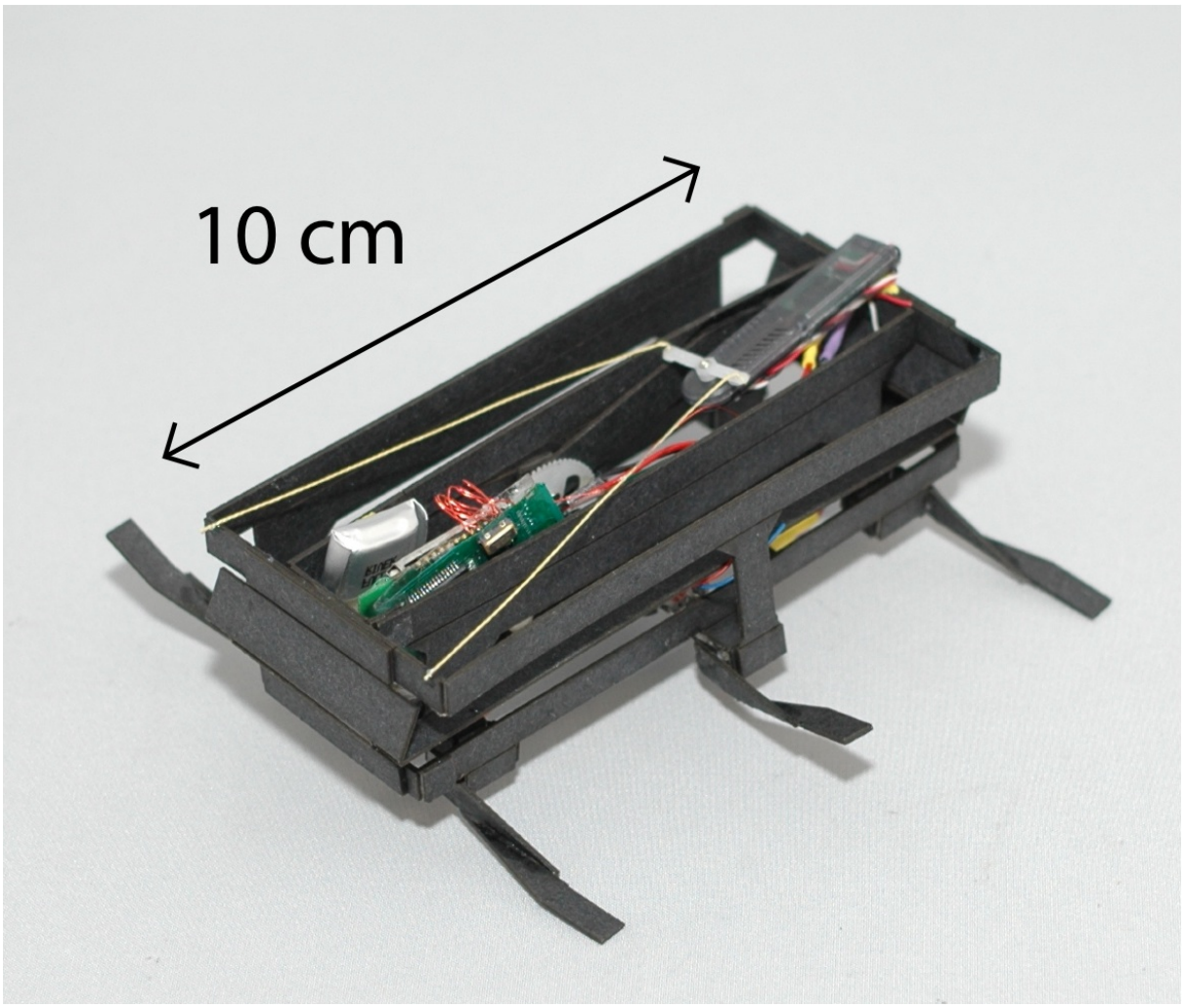

Fig. 1. DASH: a power autonomous hexapedal robot.