Smart Actuators for Biomorphic Systems

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A comparative review of actuation technologies will be presented. Innovative mechanism ideas that combine high force and deflection as required for targeted applications will be described. Flexible smart actuators are obtained utilizing real time adaptive bio-morphic controls. Such flexible smart actuators constitute an enabling technology for a variety of biomorphic systems ranging from small, agile biomorphic explorers that emulate biological mobility to much larger humanoid like anthropomorphic **systems . Due to their potential** ability to explore difficult, hard-to-reach terrain, bio-morphic explorers are promising for a variety of applications in law enforcement, hazardous environment inspection, toxic waste avoidance/ elimination, and search/rescue in disaster areas such as earthquake sites. The control mechanisms used for the actuators are based on biological principles: a neurally inspired controller (i.e., a neural network) is generated using a genetic algorithm. We propose the use of Banked Stimulus-Response (BSR) controllers, neural network which provides a mapping between the current state of the robot (as measured by sens variables such as internal actuator angles, velocity, and internal periodic clocks) and a target internal configuration (configuration of internal actuator angles). These controllers are evolved using genetic algorithms. The methodology is general to the class of robots whose skeletal structures are defined by articulated figures; given a particular biomorphic explorer, it will be relatively simple to automatically **generate BSR controllers for the explorer. Flexible actuators offer the versatility of both shape control along with mobility attribute control.**