Researcher to create robotic locomotion that mimics amoeba

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Creating a robotic locomotion mechanism based on the motion of single-cell organisms is the goal of Virginia Tech College of Engineering researcher Dennis Hong, who has received a National Science Foundation Faculty Early Career Development Program (CAREER) Award.

Hong, an assistant professor of mechanical engineering, secured the five-year CAREER grant, which is worth more than $400,000 and is the National Science Foundation's most prestigious award for creative junior faculty who are considered likely to become academic leaders of the future.

Hong is designing his Whole Skin Locomotion (WSL) mechanism to work on much the same principle as the pseudopod — or cytoplasmic "foot" — of the amoeba. With its elongated cylindrical shape and expanding and contracting actuating rings, the WSL can turn itself inside out in a single continuous motion, mimicking the motion of the cytoplasmic tube an amoeba generates for propulsion.

"Our preliminary experiments show that a robot using the WSL mechanism can easily squeeze between obstacles or under a collapsed ceiling," Hong said. The mechanism, which can use all of its contact surfaces for traction, can even squeeze through holes with diameters much smaller than its normal width.

"This unique mobility makes WSL the ideal locomotion method for

search-and-rescue robots that need to travel over or under rubble," said Hong, who hopes his research will help promote the concept of bio-inspiration in robot design. "The mechanism also has the potential for use in medical applications — such as robotic endoscopes, for example, where a robot must maneuver in tight spaces."

Hong is director of Virginia Tech's Robotics and Mechanisms Laboratory (RoMeLa), where WSL actuation models will be analyzed and prototypes will be built and tested. Hong and his graduate and undergraduate research students in RoMeLa are working on several innovative robot locomotion mechanisms, including IMPASS (Intelligent Mobility Platform with Active Spoke System, DARwin (Dynamic Anthropomorphic Robot with Intelligence), and STriDER (Self-Excited Tripedal Dynamic Experimental Robot).

He also advises Virginia Tech's Team SPRInt (Soccer Playing Robot with Intelligence) for RoboCup, an international autonomous robot soccer competition. Team SPRInt is the only U.S. team that passed the competition's pre-qualification rounds.

Each CAREER project also includes an educational component. A new summer robotics research program for promising minority high school students from economically depressed regions will be offered through Hong's project. The robot prototypes developed by these students will be demonstrated at events such as FIRST robotic competitions and at local high schools to promote interest in science and engineering.

Source: Virginia Tech

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