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Electroactive Polymers as Artificial Muscles – Reality and Challenges

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For many, the idea of a human with bionic muscles immediately conjures up images of science fiction — a superhuman character in a TV series. With bionic muscles, the hero is portrayed with strength and speed far superior to any normal human. As fantastic as that idea may seem, recent developments in electroactive polymers (EAP) may one day make such bionics possible. New effective EAP materials are increasingly being reported where novel mechanisms that are biologically inspired are emerging with lifelike response and more flexible configurations. Worldwide efforts are currently underway to develop the infrastructure for making these materials as practical actuators. These efforts include addressing the science and engineering challenges. In recognition of the need for cooperation in this multidisciplinary field, the speaker initiated and organized a series of international forums that include annual SPIE conferences, the WW-EAP Newsletter and webhub, edited a comprehensive book on this subject and is continuing to make helping initiatives. In 1999, he challenged the worldwide science and engineering community of EAP experts to develop a robotic arm that is actuated by artificial muscles to win an arm wrestling match against a human opponent. Progress towards this goal will lead to significant benefits, particularly in the medical area, including effective prosthetics. In this paper, the field of EAP as artificial muscles will be reviewed covering the state of the art, the challenges and the vision for the progress in future years.

Biography

Dr. Yoseph Bar-Cohen is a physicist specializing in electroactive materials and mechanism as well as ultrasonic Nondestructive Evaluation (NDE). He is a Senior Research Scientist, and Group Leader at Jet Propulsion Laboratory (JPL) responsible for the NDE and Advanced Actuators (NDEAA) (<http://ndeaa.jpl.nasa.gov/>) Lab. He is a Fellow of two technical societies: SPIE and ASNT. He received his Ph. D. in physics (1979) from the Hebrew University, Jerusalem, Israel. His notable discoveries include the leaky Lamb waves (LLW) and polar backscattering (PBS) phenomena in composite materials. He (co)authored over 240 publications, numerous presentations at national and international conferences, (co)chaired 20 conferences, has 15-registered patents and he is the (co)editor of 3 books, with subjects that include electroactive polymers and biomimetic robots. He is the initiator of the SPIE Conf. on EAP, chairing it since 1999. His scientific and engineering accomplishments have earned him the 2001 NASA Exceptional Engineering Achievement Medal, the 2001 SPIE’s NDE Life Time Achievement Award, and many other honors and awards.