

1. **SUBMIT TO:** Cent-clclcc SS08
2. **CONFERENCE TITLE:** Smart Structures and Integrated Systems
3. **ABSTRACT TITLE:** Flexible, 1 row-mass Robotic Arm Actuated by Electroactive Polymers (EAP) and Operated Equivalently to 1 human Hand, **CONFERENCE CHAIR:** Marc E. Regelbrugge, Lockheed Martin Palo Alto Advanced Technology Ctr.
4. **AUTHOR LISTING:** Y. Bar-Cohen^a, Y. Xue^a, M. Shahinpoor^b, J. Simpson^c, and J. Smith^c

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5. **PRESENTATION:** Oral

6. **ABSTRACT:** Actuation devices are used for many space applications with an increasing need to reduce their size, mass, cost and power consumption. Under a JPL's telerobotic task, efforts are made to develop EAP materials that provide large displacements, and two EAP categories were identified to produce large actuation strain. These categories include (a) ion-exchange membrane - platinum (IEMP) composite and (b) electrostatically driven polymer actuators. A comparison between EAP and the widely used traducing actuators shows that, while lagging in force delivering capability, these materials are superior in mass, power consumption and displacement levels. Several muscle configurations were constructed to demonstrate the capabilities of these EAP actuators. Further, using actuators that represent these two categories, a miniature robotic arm has been developed with unique articulation capabilities. Strings consisting of electrostatically driven films are used to form the equivalent of a human arm. The arm was connected to an end-effector gripper with four IEMP composite strips that bend similar to fingers to allow grabbing and holding objects, such as rocks. The gripper operates with the capability to bend both forward and backward which exceeds the human hand capability.

7. **KEY WORDS:** flexible actuators, electroactive polymers, active materials, ionomers

8. **BRIEF BIOGRAPHY:** Dr. Yoseph Bar-Cohen is the Principal Investigator for NDE and Advanced Actuators at JPL, Pasadena, CA. He is developing ultrasonic NDE methods and systems, space-worthy high torque piezoelectric motors, electroactive polymeric muscle actuators, and high power ultrasonic techniques for medical applications. Dr. Bar-Cohen received his Ph.D. in physics (1979) from the Hebrew University at Jerusalem, Israel. He has been the pioneer in developing the leaky Lamb waves and ultrasonic polar backscattering. He is the author of more than 120 publications and holds many patents. He is an Adjunct Professor at the University of California, Los Angeles (UCLA) and a Fellow of the American Society of Nondestructive Testing.