

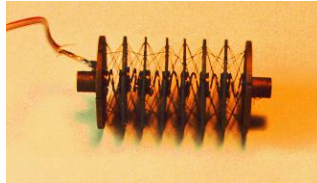
# Actuators 1

## Chairs: Michael J. McCarthy, Ken Waldron

### Constrained Force Control of Shape Memory Alloy Actuators

D. Grant and V. Hayward  
McGill University

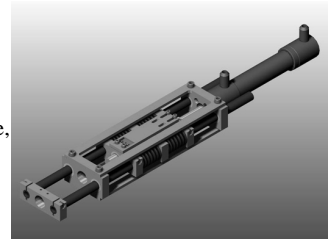
- Experimental results are presented to show that SMA actuators can control forces rapidly and precisely.
- A force transduction model for SMA actuators is developed and a two stage switching controller is designed using this model.
- An antagonistic pair that weights 6g (most of it is superfluous) has a peak force of 7 N. It can apply force under control with a 0.5
- Continuous operation was also verified.



### Force Controllable Hydro-Elastic Actuator

David Robinson and Gill Pratt  
Massachusetts Institute of Technology

- Develop a force controllable hydraulic actuator.
- Control the strain of a series elastic element.
- Low impedance, shock tolerance, good bandwidth and high power density.
- Excellent force control with large dynamic range.

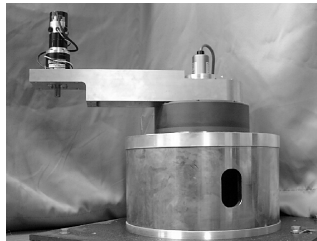


### Development and Analysis of Actuator With ER Damper

N. Takesue<sup>1</sup>, G. Zhang<sup>1</sup>, M. Sakaguchi<sup>1</sup>, J. Furusho<sup>1</sup> and Y. Kiyosawa<sup>2</sup>

<sup>1</sup>Osaka University and <sup>2</sup>Harmonic Drive Systems, Inc.

- Motivation
- Development
- Analysis
- Experiments



### Velocity Dependence of the Characteristics of Harmonic Drive Built-in Torque Sensing

M. Hashimoto<sup>1</sup>, T. Ishizuka<sup>2</sup>, I. Godler<sup>3</sup> and M. Horiuchi<sup>4</sup>

<sup>1</sup>Shinshu University, <sup>2</sup>Kagoshima University, <sup>3</sup>Kyushu University and

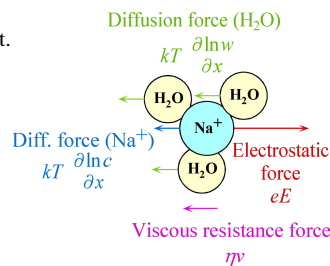
<sup>4</sup>Harmonic Drive Systems, Nagano Japan

### An Actuator Model of ICPF for Robotic Applications on the Basis of Physicochemical Hypotheses

S. Tadokoro<sup>1</sup>, S. Yamagami<sup>1</sup>, T. Takamori<sup>1</sup> and Keisuke Oguro<sup>2</sup>

<sup>1</sup>Kobe University and <sup>2</sup>Osaka National Research Institute

- Accurate ICPF modeling for robotic application development.
- Stress generation model by ionic motion in the membrane.
- High accuracy on transient response and nonlinearities.
- CAD of soft gel actuators for future robotic design.



### Modeling and Motion Control of an Actuator Unit using ER Clutches

M. Sakaguchi, G. Zhang and J. Furusho  
Osaka University

- Development of an Actuator Unit Using ER Fluid
- Good Response, Low Inertia and Safety Characteristics
- Force and Velocity Response Models of the ER Actuator Unit
- Experimental Results of the Motion Control

