## *Electrostatic forces are weak and friction can reduce transmitted force. Here we used friction to develop a MEMS actuator with large force.*



Problem: Friction reduces force ...

Solution: Let's take advantage of friction

Turn to nature's inchworm as inspiration for a MEMS device



## **Realization: Nanotractor**

## A high performance actuator and a model friction





M. P. de Boer, D. L. Luck, W. R. Ashurst et al. "High Performance Surface-Micromachined Inchworm Actuator" J. MicroElectroMechanical Systems, Feb. 2004