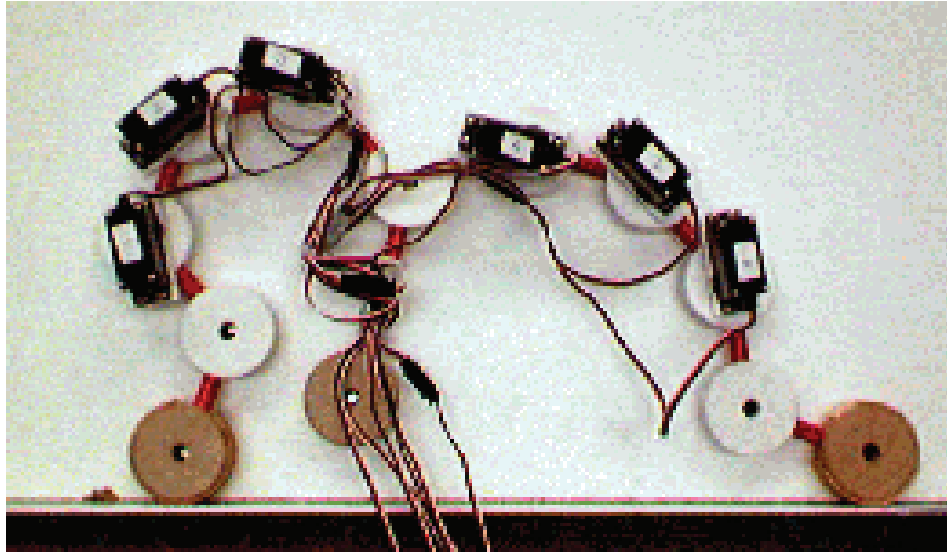
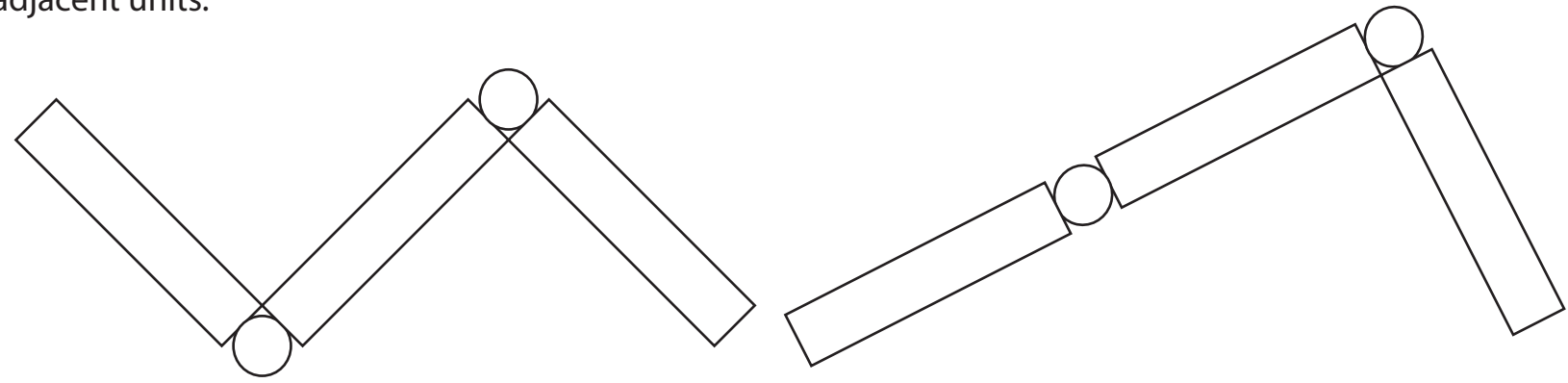


# Movements

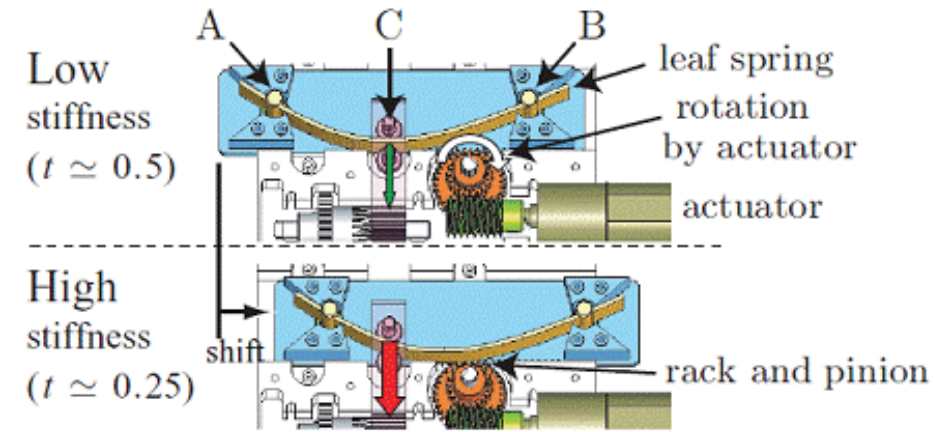


**Simplest.** Less mechanical elements.  
Motors are **bulky** and **heavy**.  
Obstructing the connection between adjacent units.



**Inchworm** movement for a single unit

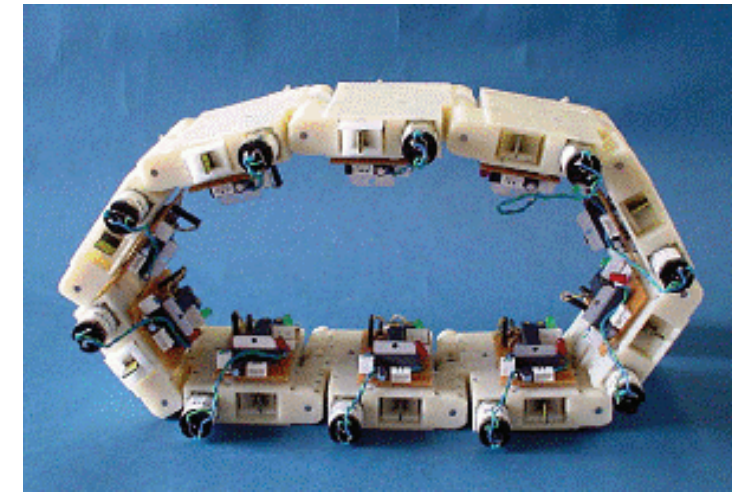
Actuator right at the center of Rotation



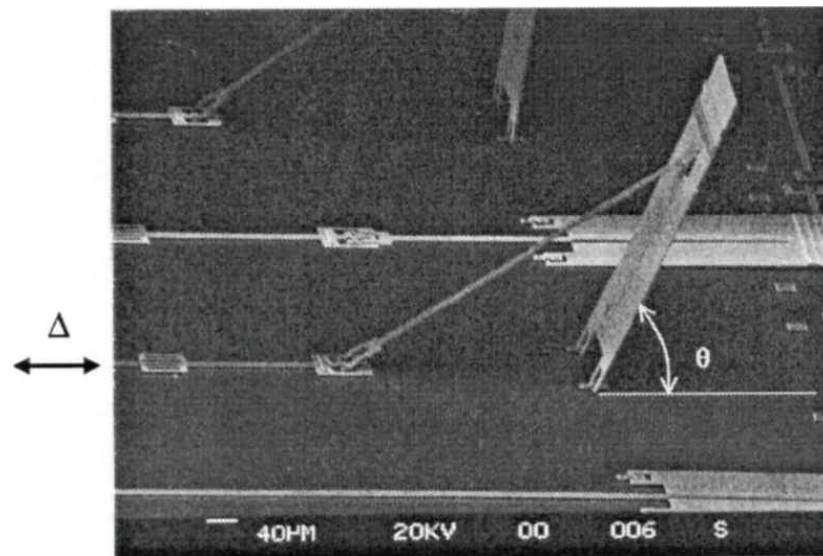
Save space by remotely locate actuators.

More Components need to be fabricated.

Movements for collective units



Use of Mechanical Gears



Actuator can be **remotely** located.  
Possibly save some spaces.

Tendon (string) may obstruct connection for units.

A string can be wrapped by a motor.

Use of Tendon at Hinges (Linear Movements to Rotation)

BOARD TITLE:  
Movements

BOARD #:  
1/4

GROUP/DESIGNER'S NAME:  
Taro Narahara

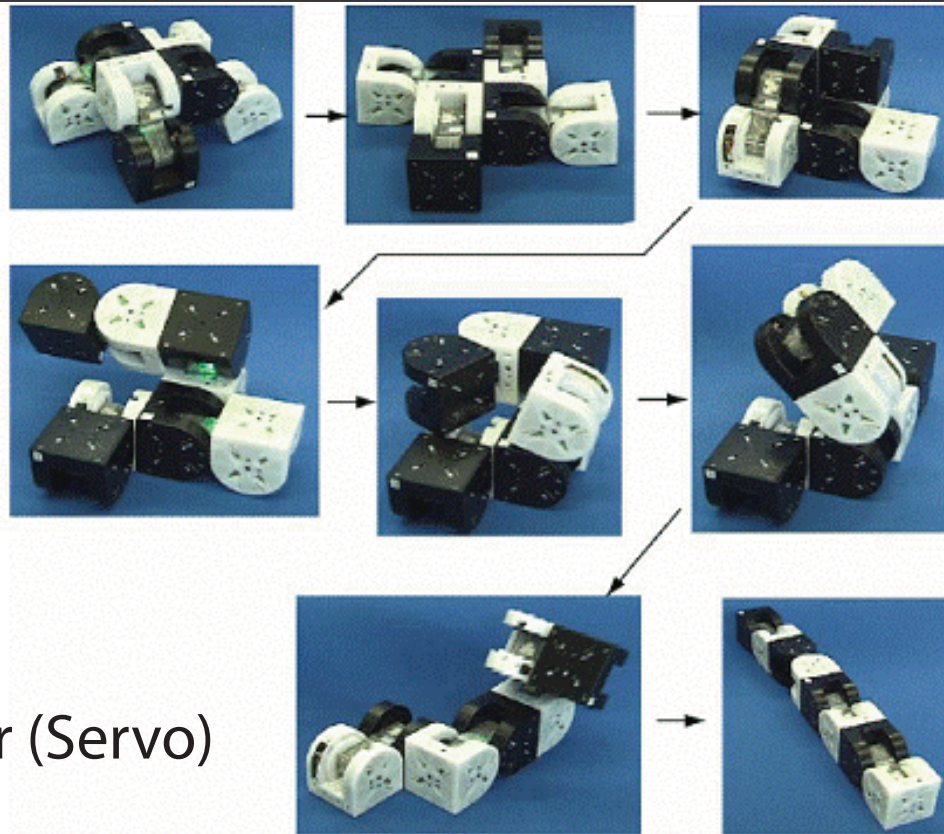
TOPIC: type here

SCALE: type here

# Actuation Devices

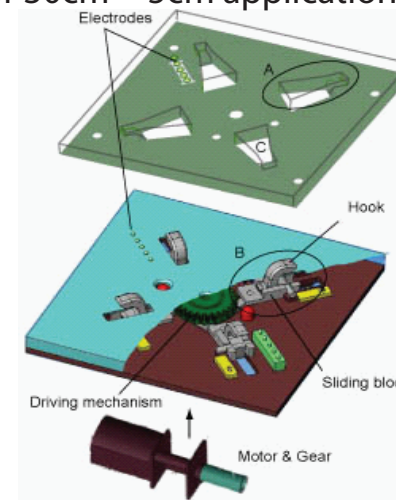


Electromagnetic Motor (Servo)



Motors in various sizes are available.  
No need to make motors.

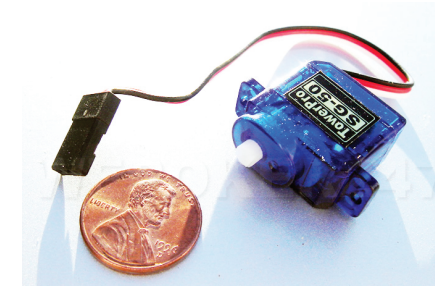
good for 30cm ~ 5cm application size.



Mechanical joint using Motor



\$12.00  
Torque 3.40 kg-cm/47oz-in  
Size mm (L x W x H) 40.5x20.0x38.0



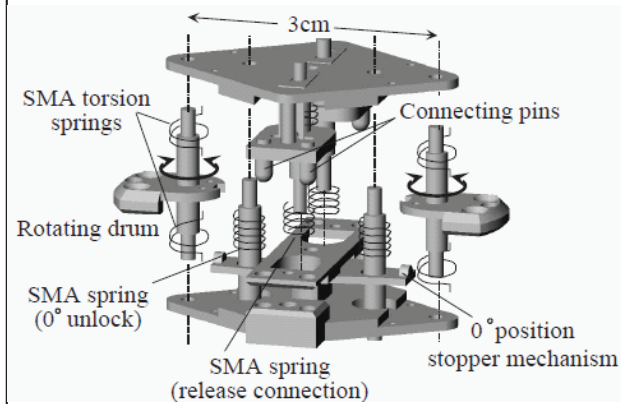
\$30.00  
Stall Torque: 0.8kg/cm  
20.9mm x 11.4mm x 22mm  
Weight: 5.0g

Small (Micro) Scale Applications

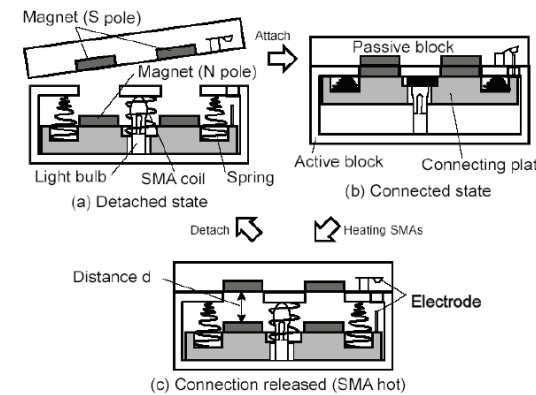
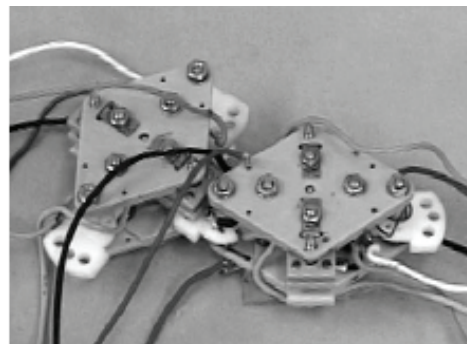
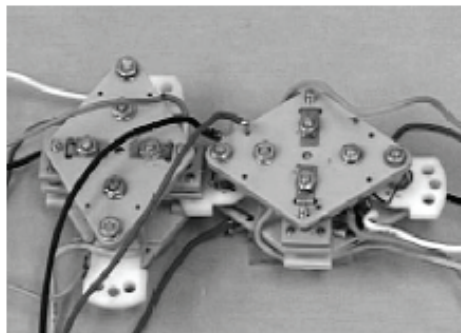
Good for Latch mechanism for connections.

Hard to control (getting enough torque & range of motion)

Need to fabricate system



SMA (torsion springs)

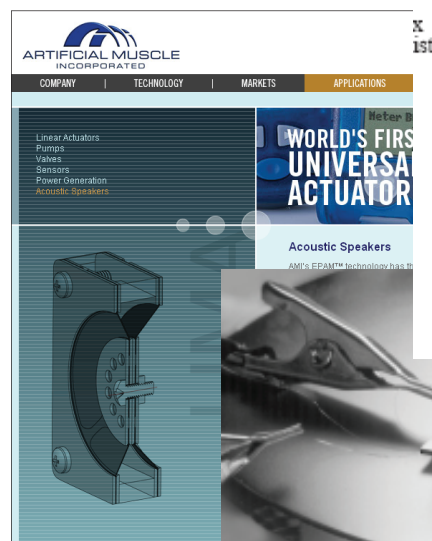


joint using SMA & Permanent Magnet



Hydraulic & Pneumatic Cylinders

Large (Macro) scale applications  
Linear motion  
Expensive



Electroactive Polymer Artificial Muscle (EPAM)



micro scale applications  
motion range and strength are still in question for our purpose.



Artificial Air Muscles

ACTIVE ELEMENTS

MIT: How to Make Something that Makes (Almost) Anything

BOARD TITLE:	Motion Actuation Devices
BOARD #:	1/4

GROUP/DESIGNER'S NAME:	Taro Narahara
TOPIC:	type here
SCALE:	type here