Open Soft Machines

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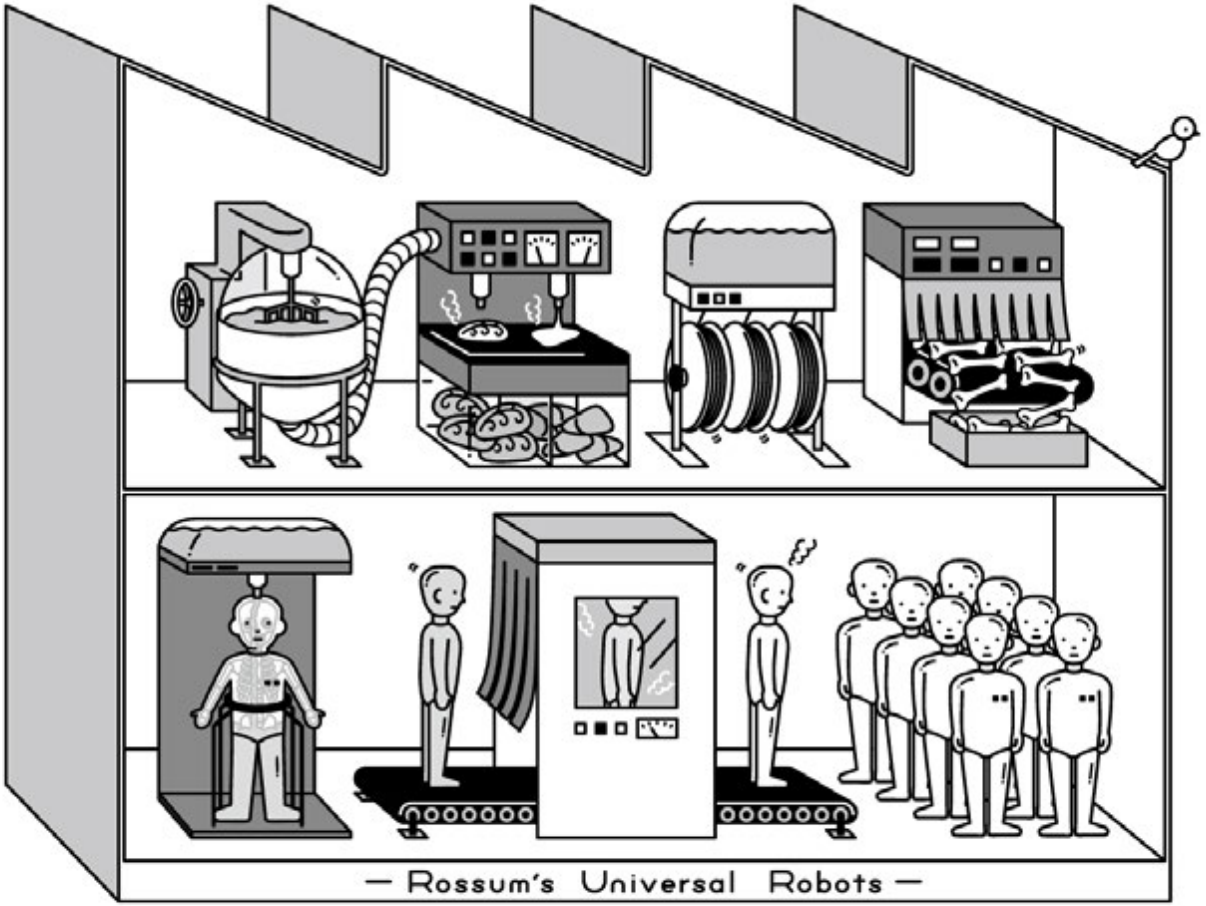
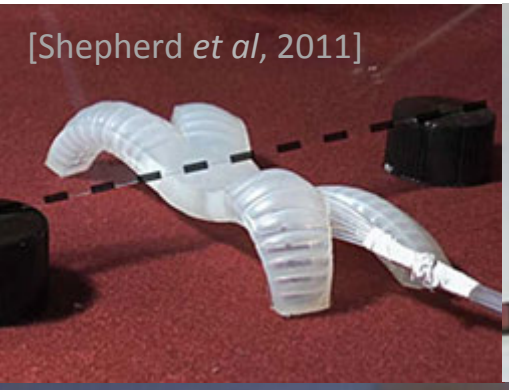


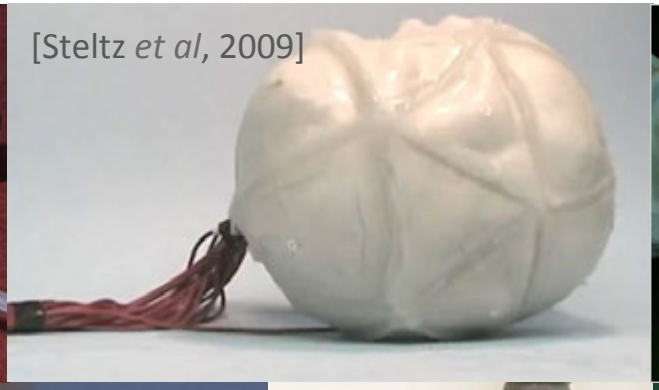
“Mixers can mix the dough for a thousand robots at a time. Then there are the vats of liver and brain and so on. The bone factory. The spinning mill where we make the nerve fibers, veins, and intestine. Then there’s the assembly room where all these things are put together, it’s just like making a car.”

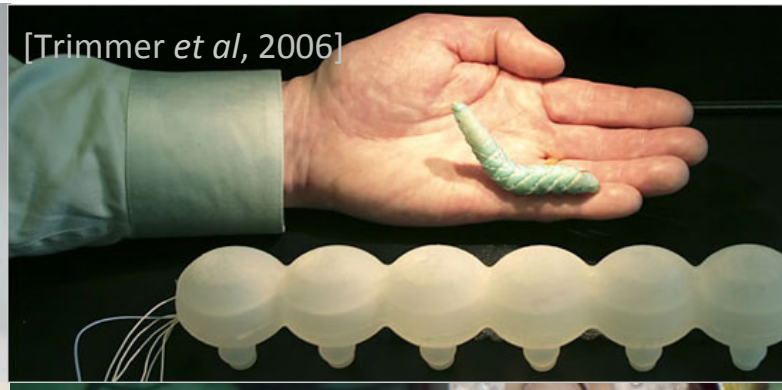
“*R.U.R*” Karel Čapek, 1920

Fabrication Challenges

- Continuum body, Integrated/embedded
  (not an assembly of modular components)
- Handling deformable materials/fluids, nonlinear properties







Recipe = materials and methods

Video-based Journal

jove

Advanced

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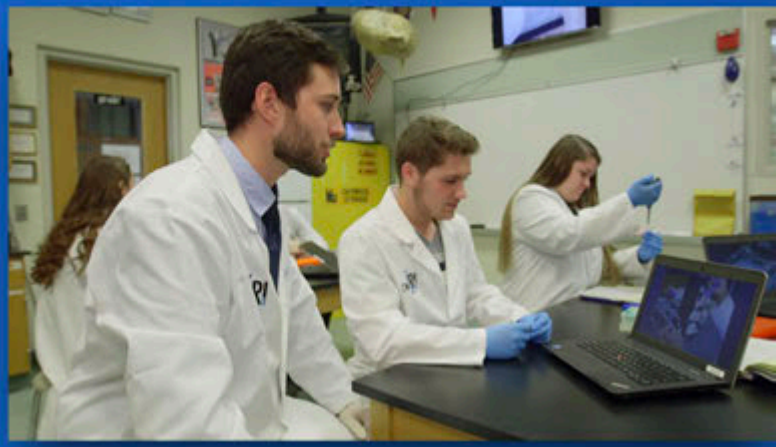

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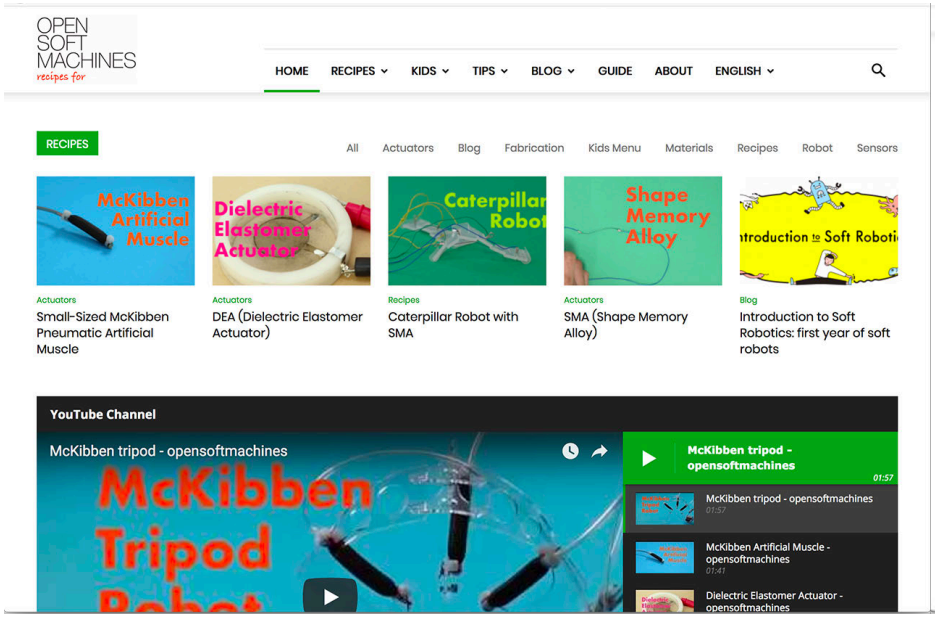
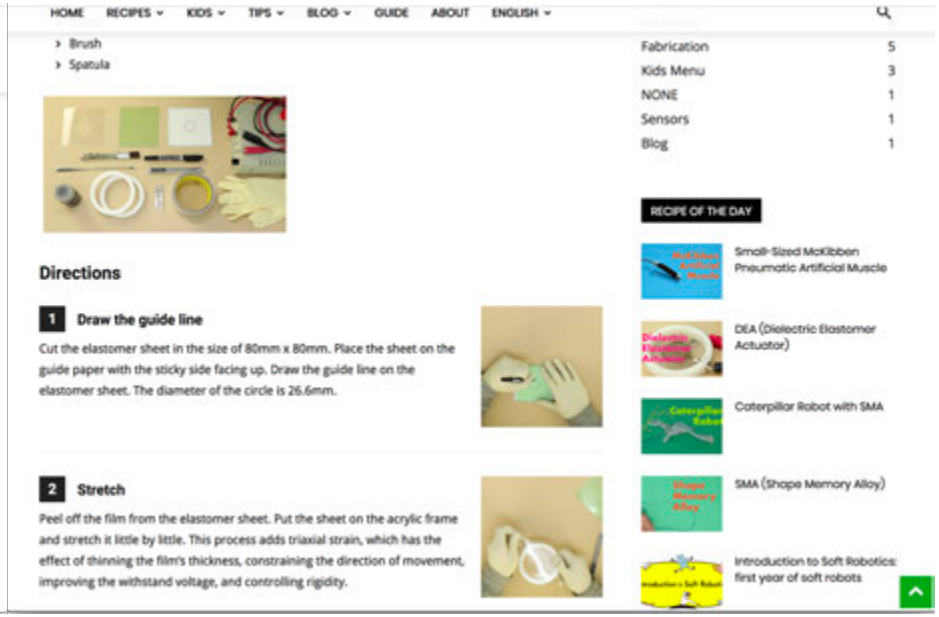
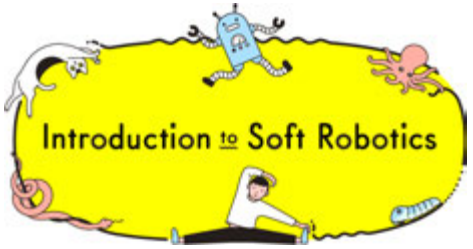
Open Soft Machines

http://opensoftmachines.com







Platform Design

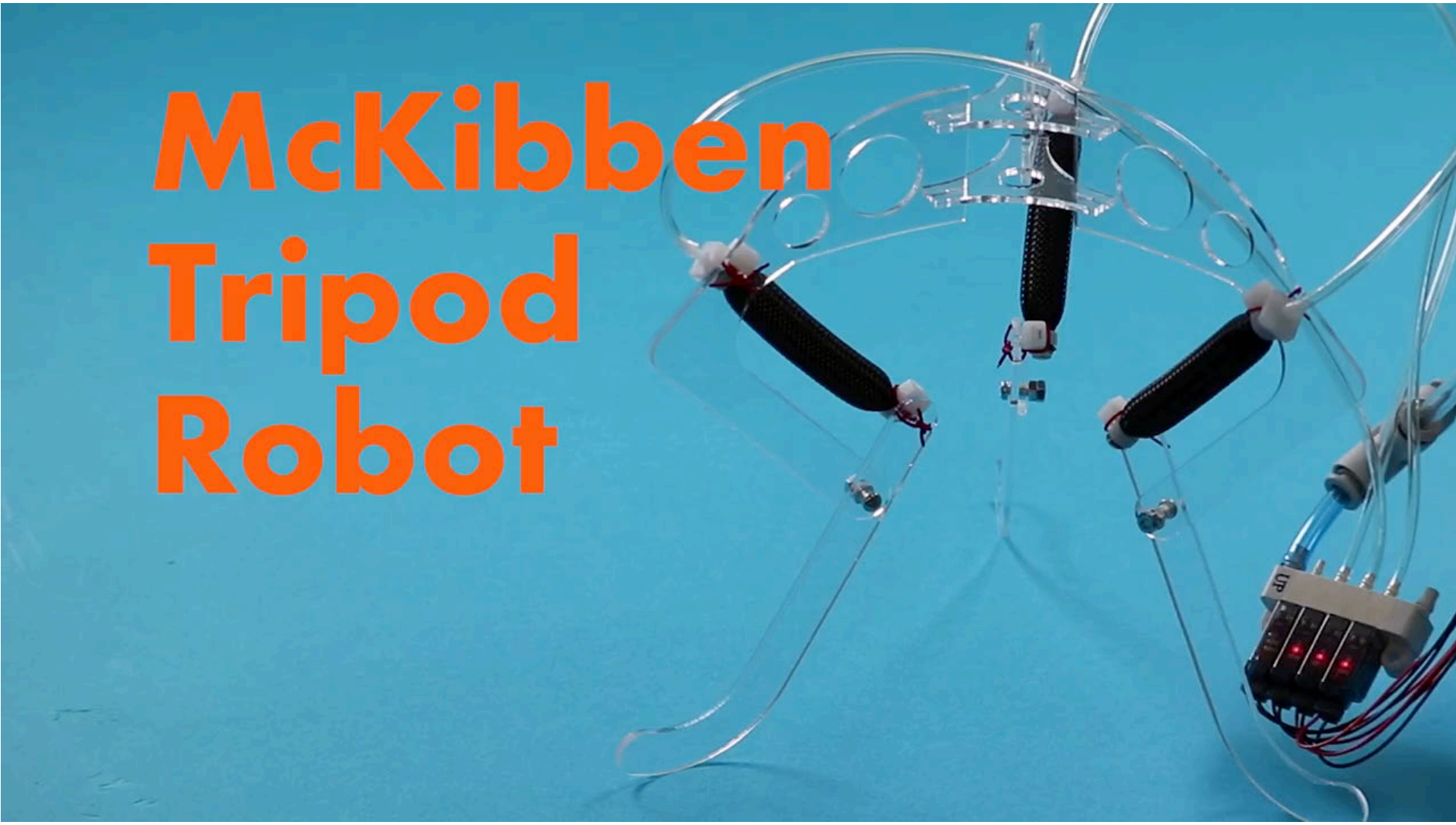
- Target Users
  - 12+ year old
  - Scientists in any discipline, educator, makers (hobbyist)
- Focus
  - Encourage a cross-disciplinary collaboration projects
  - Soft actuators/sensors, polymer and gel, biohack, compliant mechanism, system integration
- Methods
  - Video format within 2 minutes
  - Off-the-shelf material and tools

Challenges

- Reproducibility
  - Robotics papers usually have no detailed "Materials and Methods" section.
  - How-to tips
- Availability of Materials and Tools
- Citations to your papers, followers

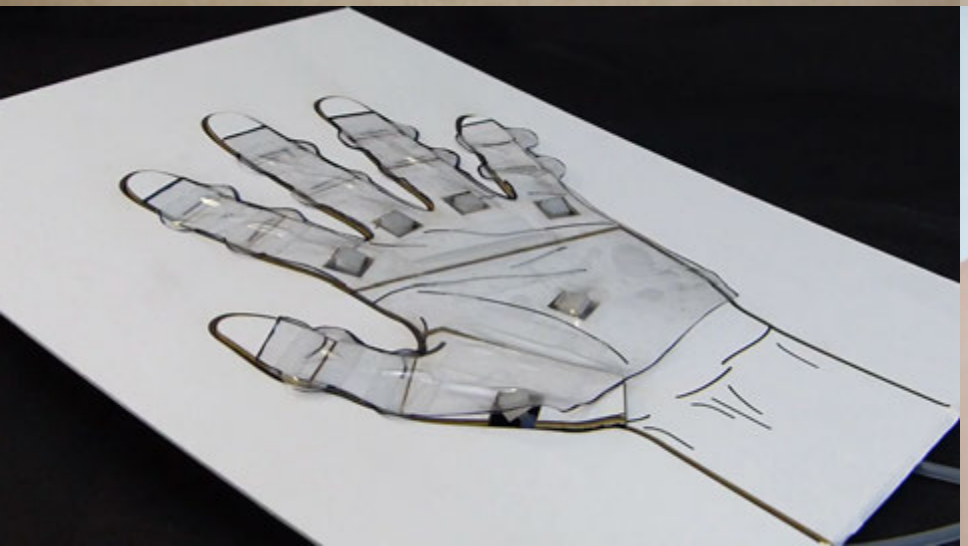
Artificial Muscles for Soft Machines

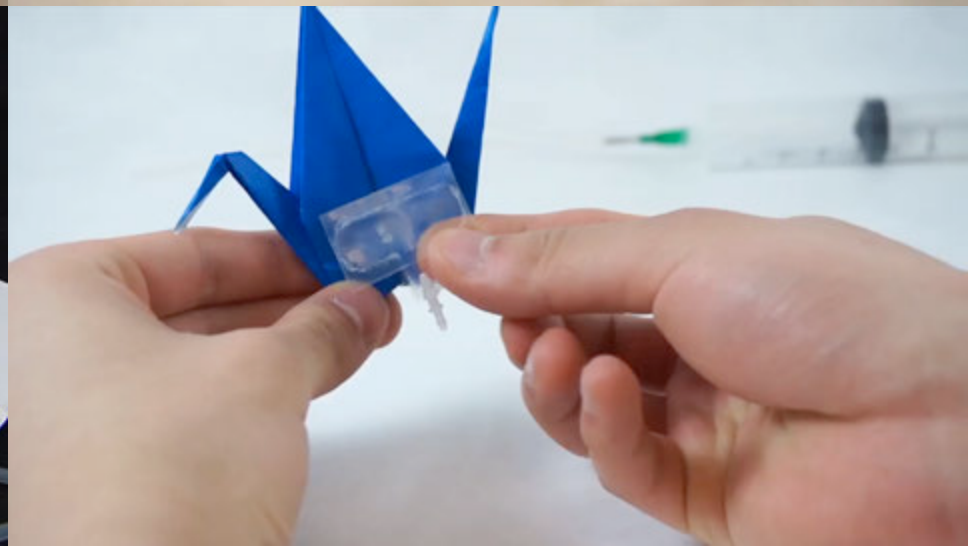

McKibben
Artificial
Muscle


McKibben
Tripod
Robot

Pouch Motor

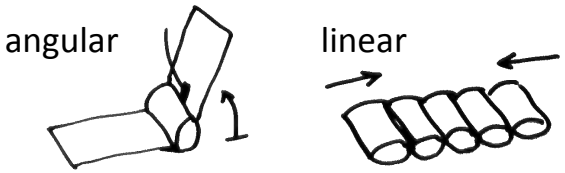
SoRo
Soft Robotics



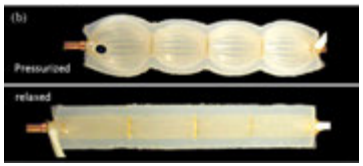


Map of Film-based Fluidic Actuators

Pouch Motor



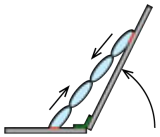
[Niiyama+, ICRA2014] [Niiyama+, 2015]



Flat PAM [Park+, 2014]

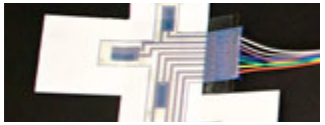
Peano Actuator [Sanan+, 2014], Otherlab

Second Generation



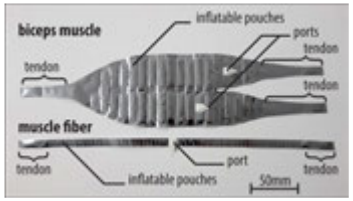
Self Folding
[Sun+, ICRA2015]

Robotic Garden
[Sanneman+, ICRA2015]



Angle Sensor
[Sun+, IROS2015]

Rat rehabilitation
[Chang+, EMBC2015]



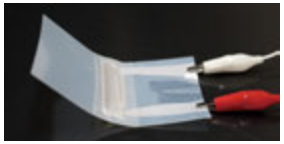
Printable PAM
[Niiyama+, Humanoids2015]

Sticky Actuator
[Niiyama+, TEI2015]

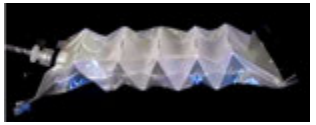
Peano Fluidic Muscle [Veale+, 2016]

aeroMorph
[Ou+, UIST2016]

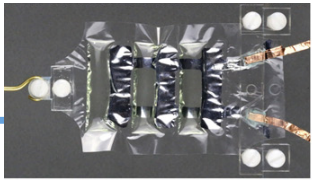
Series PAM
[Greer+, ICRA2017]



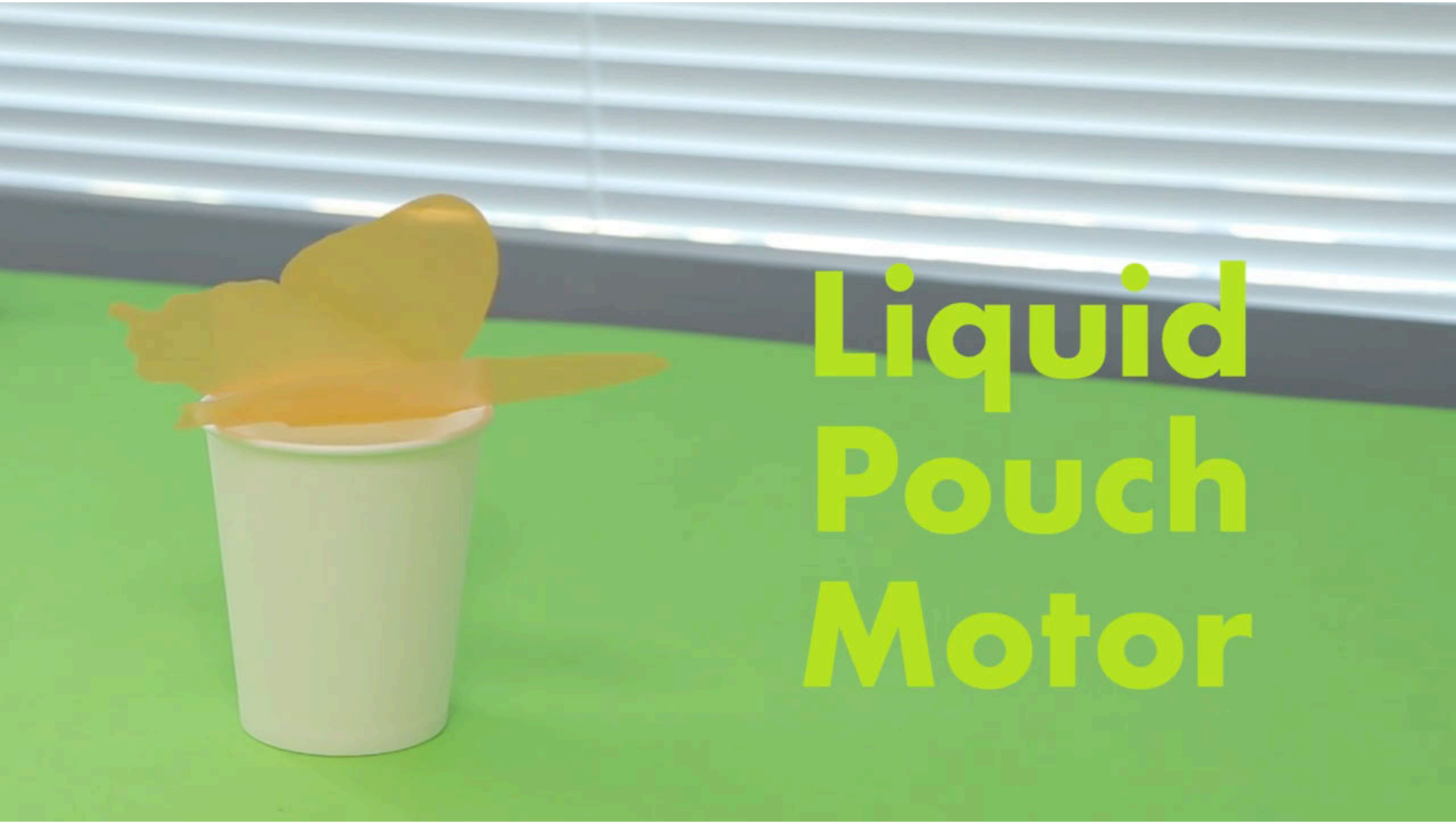
Electric Phase-change
[Nakahara+, ICRA2017]



Origami-inspired muscle
[Li+, 2017]



Peano-HASEL
[Kellaris+, 2018]


Liquid
Pouch
Motor

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