

Soft Robots

The Soft Robot Walker – An Application Example

Agenda

What we have in Store

1. **Central Differences:** Of Soft and Conventional Robots
 2. **Soft Robot Walker:** Basic Information
 3. **Soft Robot Walker:** Capabilities
 4. **Soft Robot Walker:** Overview
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Central Differences

Of Soft and Conventional Robots

Property	Soft Robots	Conventional Robots
Material	adaptable (e.g., polymers)	rigid (e.g., metals)
Adaptability	highly flexible, therefore suitable for hazardous and changing environments	lower flexibility, more suitable for predictable environments
Contact with people	safe to use around people thanks to flexible components	may require additional safety measures

Central Differences

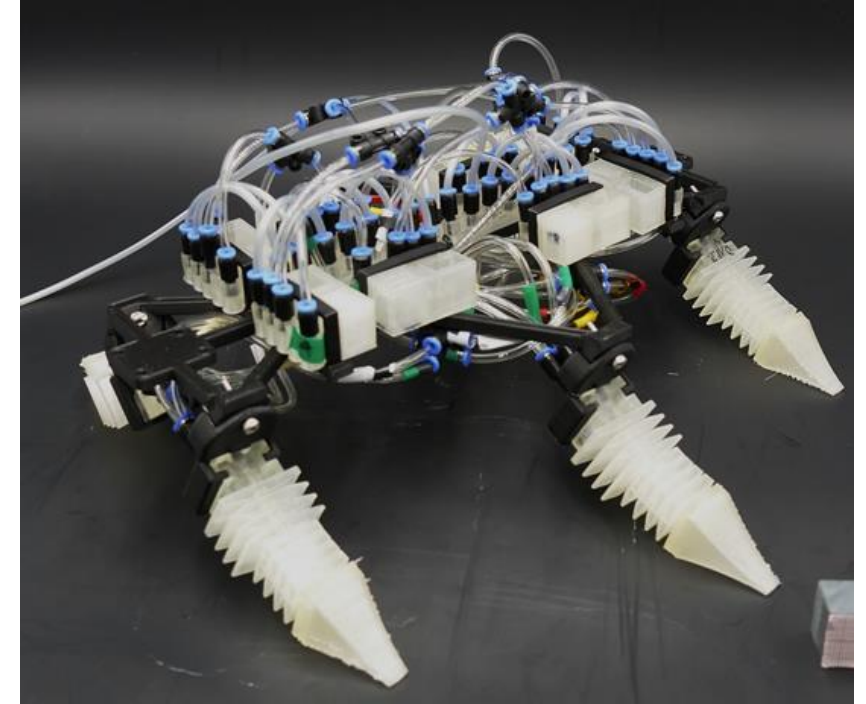
Of Soft and Conventional Robots

Property	Soft Robots	Conventional Robots
Economy	provides opportunities for reducing energy consumption	higher energy consumption for adaptation to their environment
Wear	less mechanical wear	more susceptible to wear and tear over time
Production Costs	cost-effective, 3D-printable at home in many different versions	often requires expensive and specialized machinery

Soft Robot Walker

Basic Information

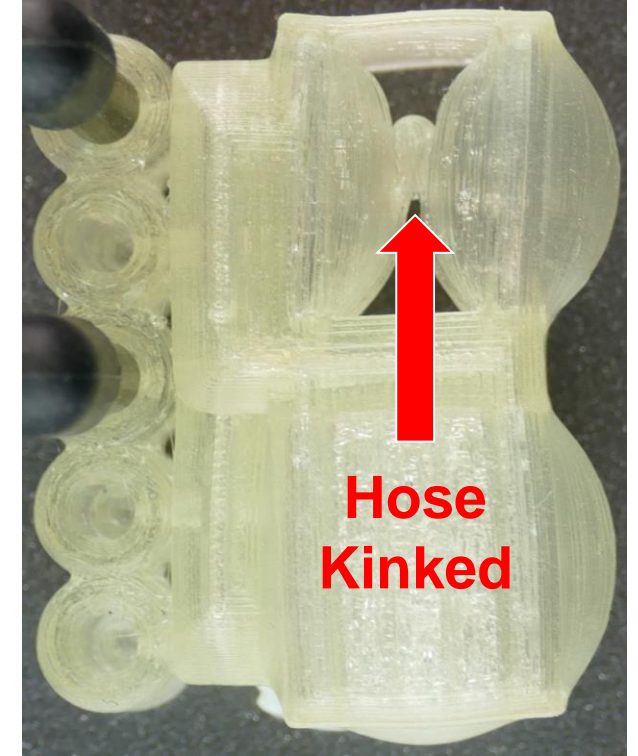
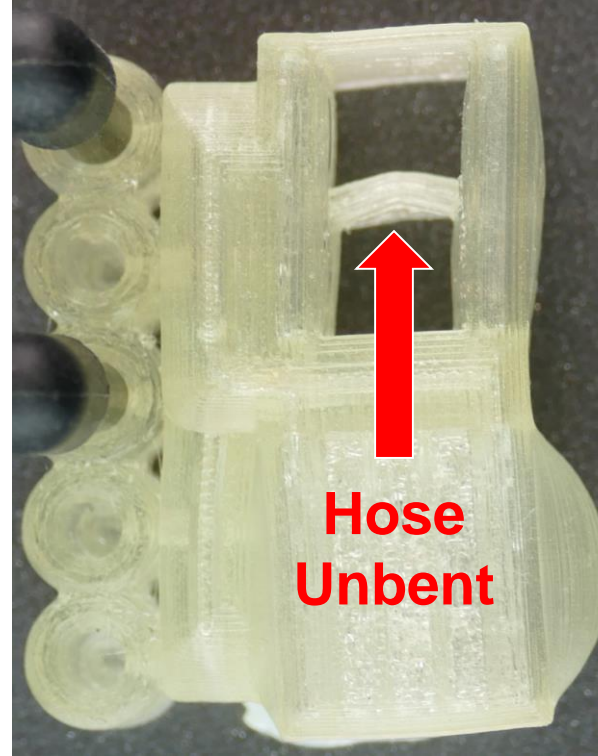
- New type of soft robot
- Movement via inexpensive 3D-printable circuits
- These can be switched on and off using a modular design principle
- The robot can be expanded as desired (modular)
- Compressed air as the solely needed energy source (hose or cartridge)



Soft Robot Walker

Basic Information

- This robot consists of modular circuits
- On and off by bending a hose between two membranes → program sequence controlled by air pressure
- Binary logic (air yes, air no / on, off / 0, 1) → comparable possibilities to those of a PC
- The more circuits are connected, the more complex the movement sequences become



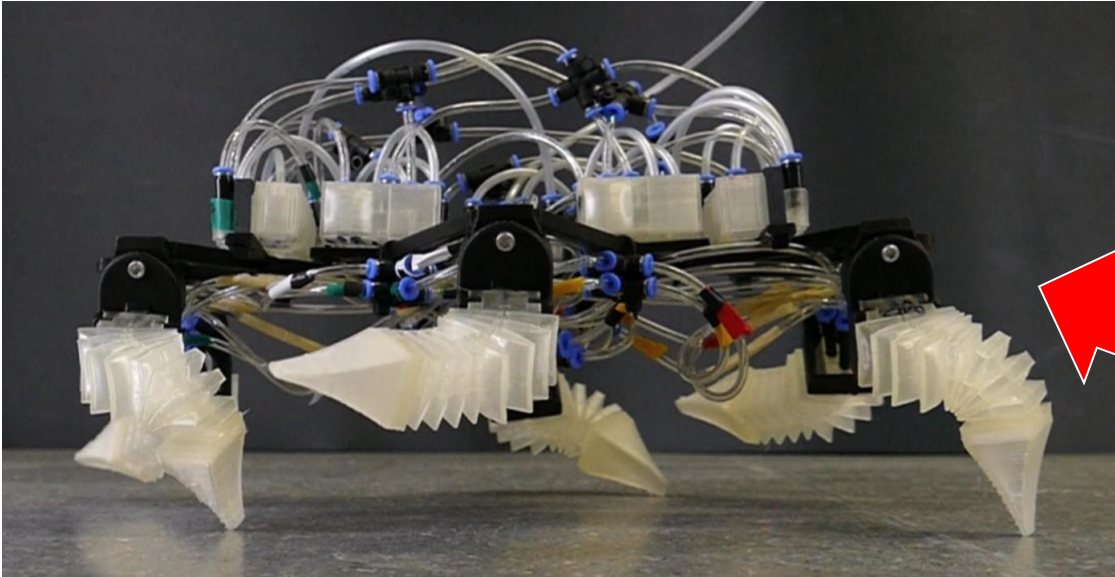
Soft Robot Walker

Video: Walking

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Soft Robot Walker

Explanation: Walking



- The robot remains stable at all times while walking



- Imitation of the walking style of a stick insect

Soft Robot Walker

Video: Obstacle Course

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Soft Robot Walker

Video: Gripping

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Soft Robot Walker

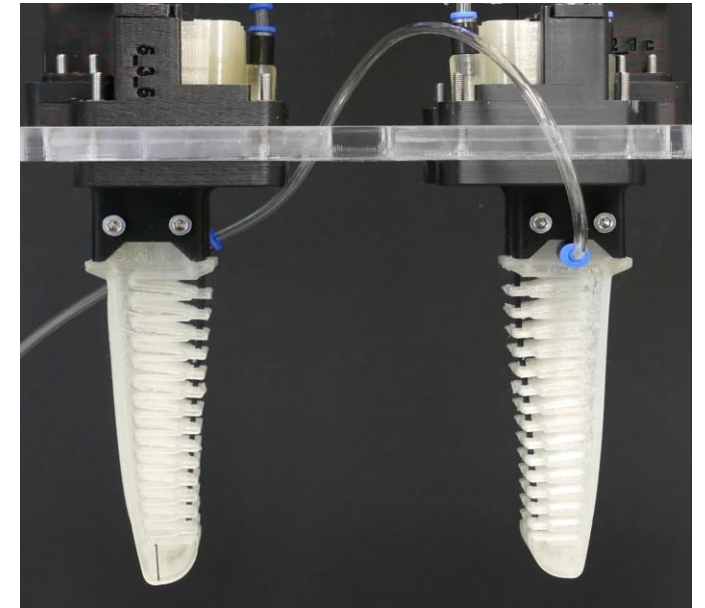
Explanation: Gripping

Arm stiffness can be adjusted using bio-inspired tendons

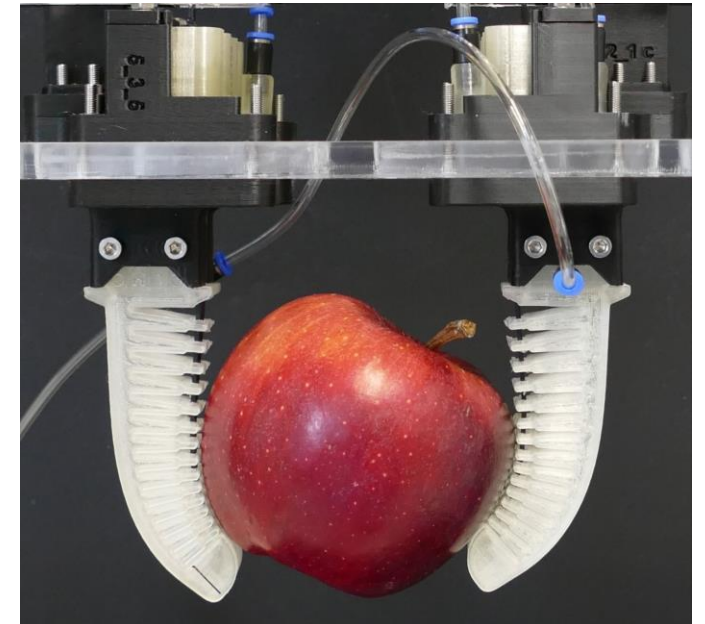
- Tendon free: low stiffness, stretching with lower air pressure
- Tendon locked: stiffness and holding force of the gripper arms increased

Advantage

- Enables more energy-efficient operation (compared to conventional soft robotic grippers)



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Soft Robot Walker

Overview

- The Soft Robot Walker belongs to a new type of soft robot.
- Walking and gripping were demonstrated.
 - The robot remains stable.
 - A modular design allows for unlimited expansion and modification.
- 3D-printed circuits
 - Completely free of any electronics
 - Interesting for potentially explosive environments, for example

Literature

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