

Shape Memory Alloy Actuators

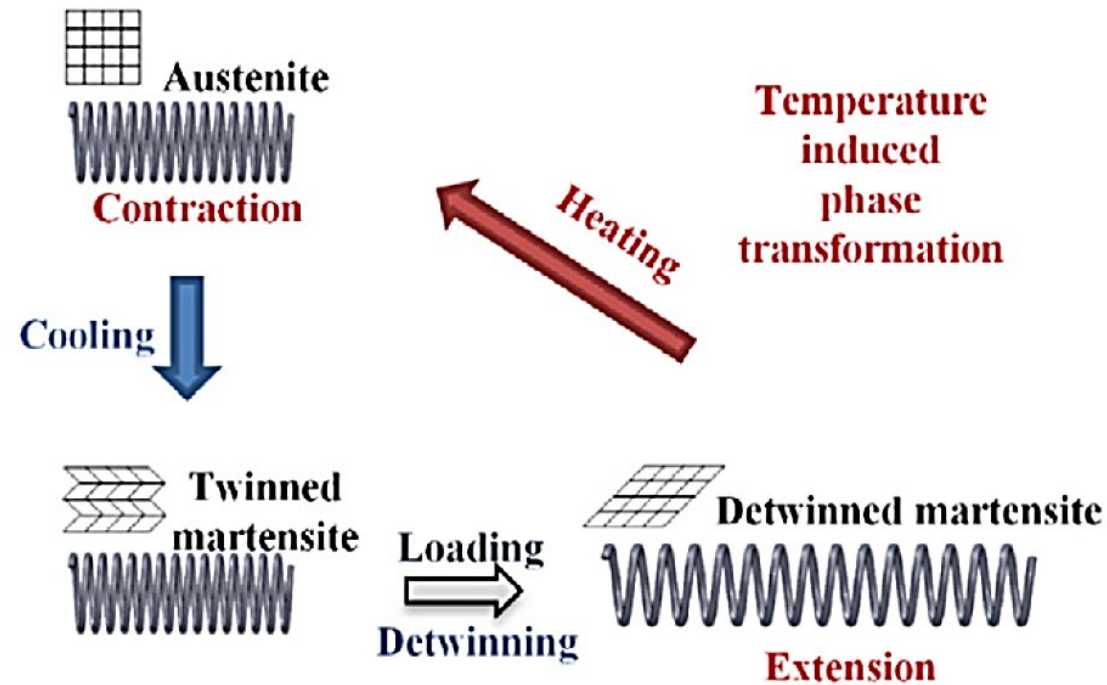
Demo: loading & bidirectional movement

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SMA properties

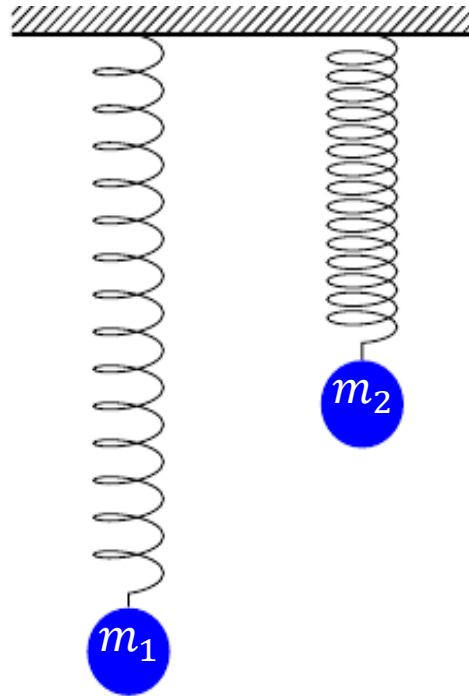
- **SMA**s: Materials that can “**memorize**” a state and/or move in the presence of **stimuli**: heat, electricity, magnetism, light, moisture, or chemical.
- Material has two states: **austenite (A)** – hot and **martensite (M)** – cold
- Shape transformation occurs with phase transition upon temperature input



Smart Materials

Part 1: Spring SMA actuator loading, you will

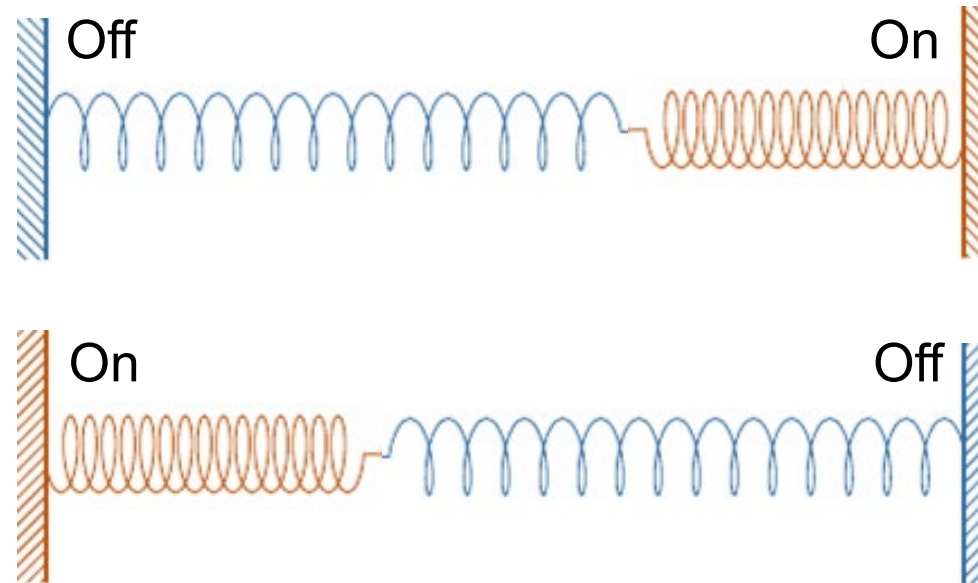
- Learn how to use Arduino to activate linear coil spring SMA actuator
- Understand force capabilities of spring SMA actuators in terms of stiffness and deflection



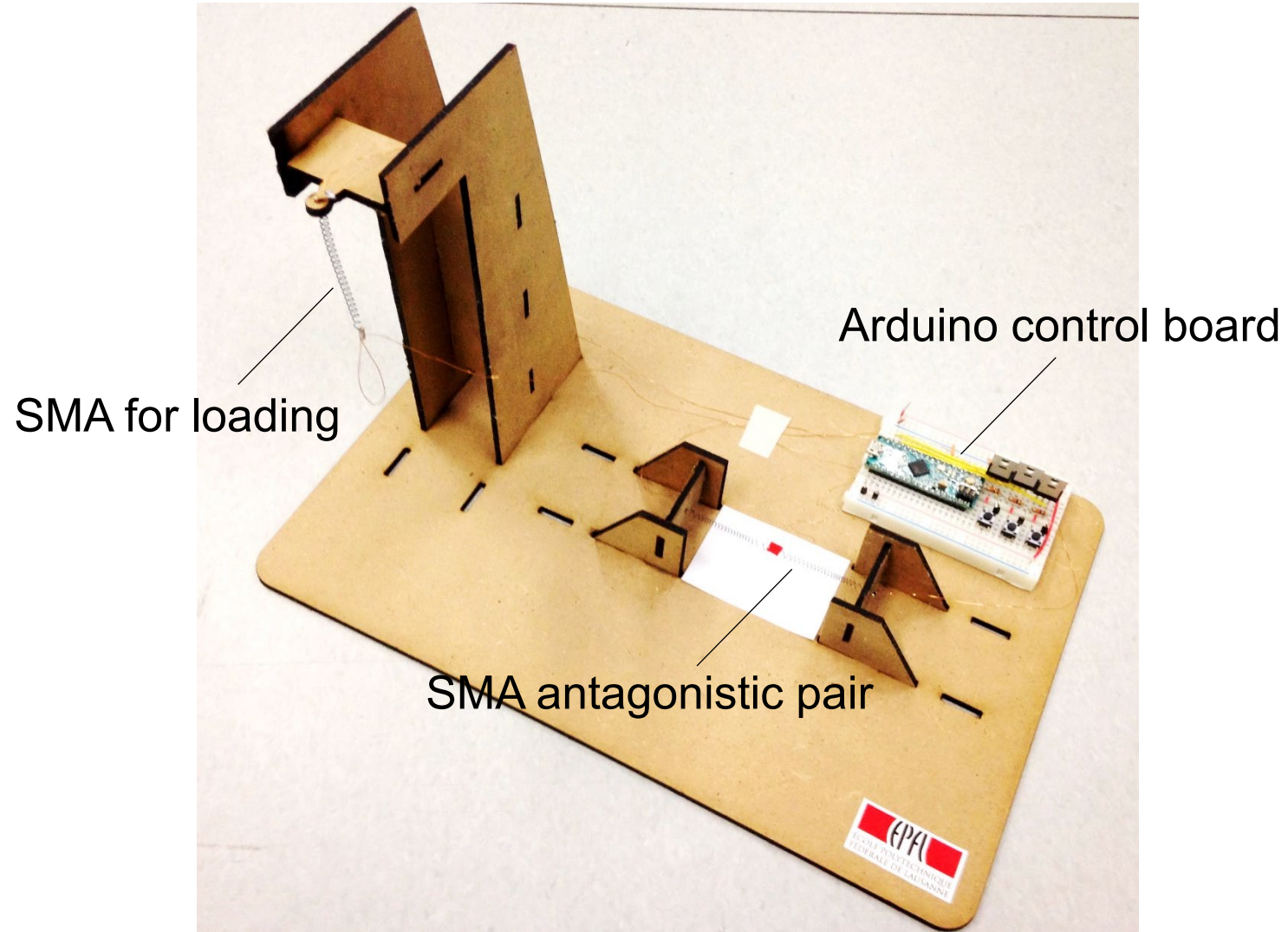
Smart Materials

Part 2: Reversible motion with spring SMA actuator. You will

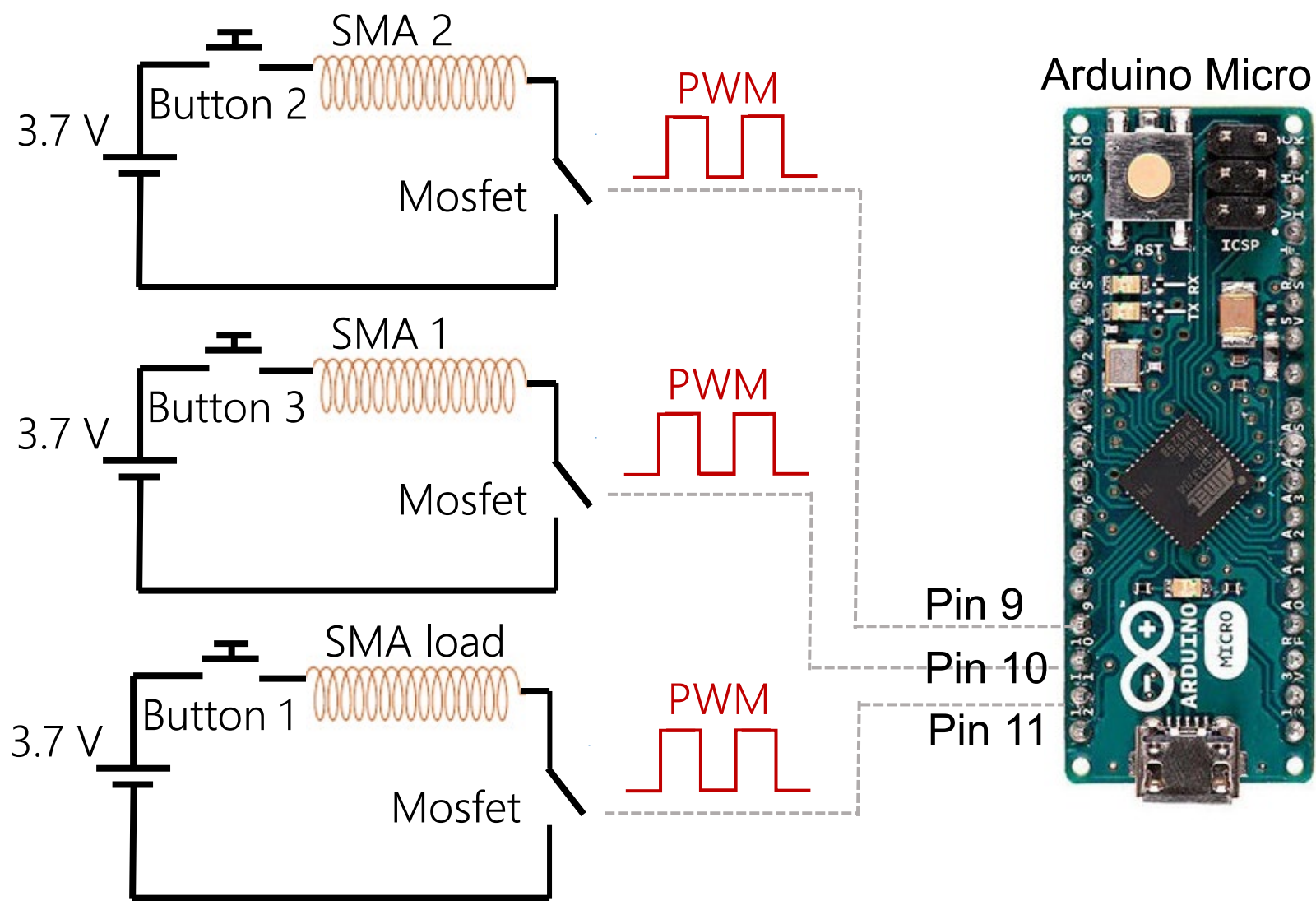
- Learn how to program an Arduino to activate two SMA actuators connected antagonistically.
- Understand bidirectional motion mechanisms using SMA.



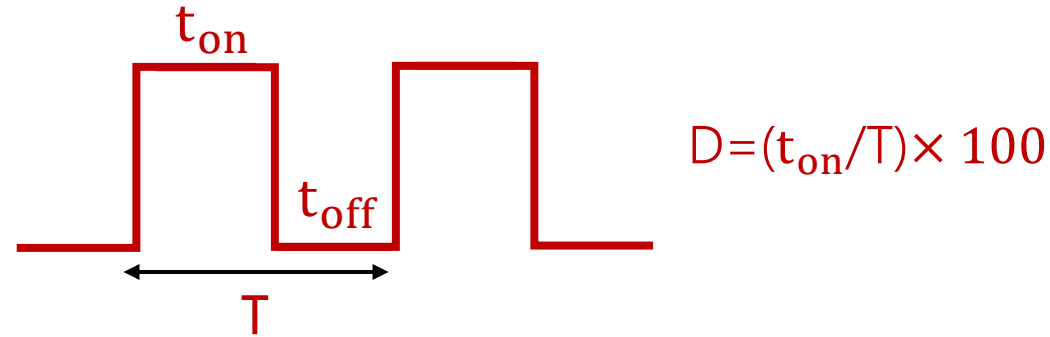
Setup



Circuit Diagram



Pulse-Width Modulation (PWM)



- PWM duty cycle $0 \% \leq D \leq 100 \%$
- Arduino Micro PWM has 8 bit resolution: $2^8 = 256$
- Digital representation: $0 \leq D \leq 255$

$$D_{digital} \approx \frac{D}{100} \times 255$$

For ex. 50 % duty = 127

Questions



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