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Proprioceptive Artificial Muscles

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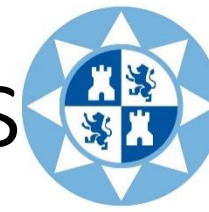
Introduction



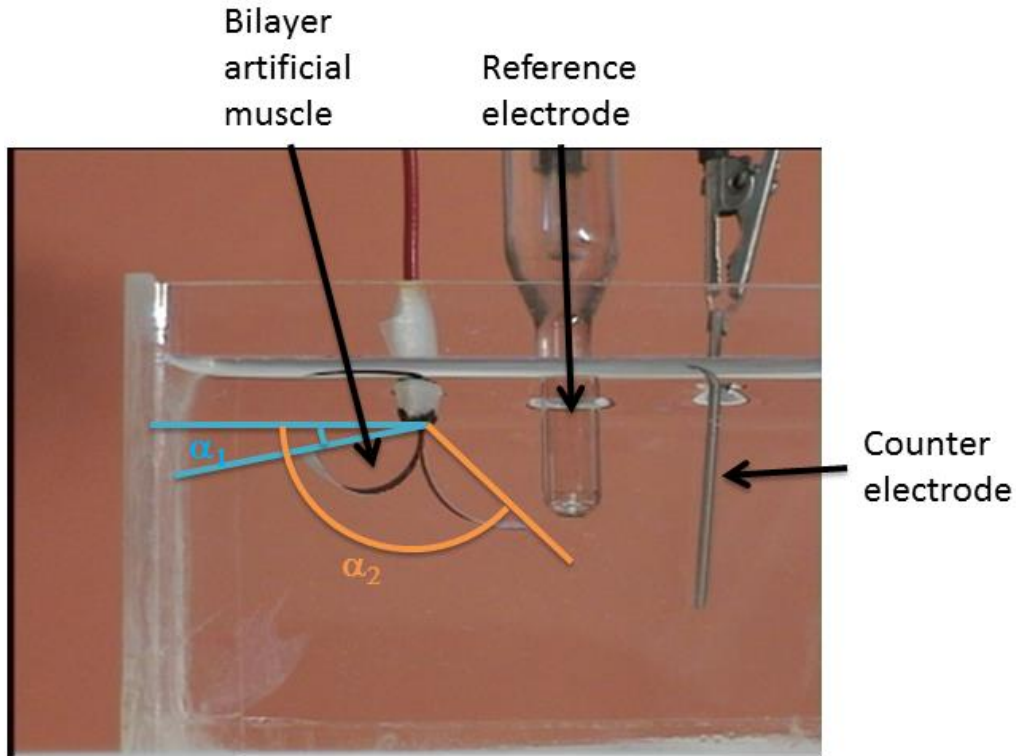
Proprioception

The term *proprioception* comes from the Latin word *proprius*, whose meaning is “own” , plus perception, and it refers to the sense of the relative position of neighbouring parts of the body and strength of effort being employed in movement.

Conducting Polymers as actuators



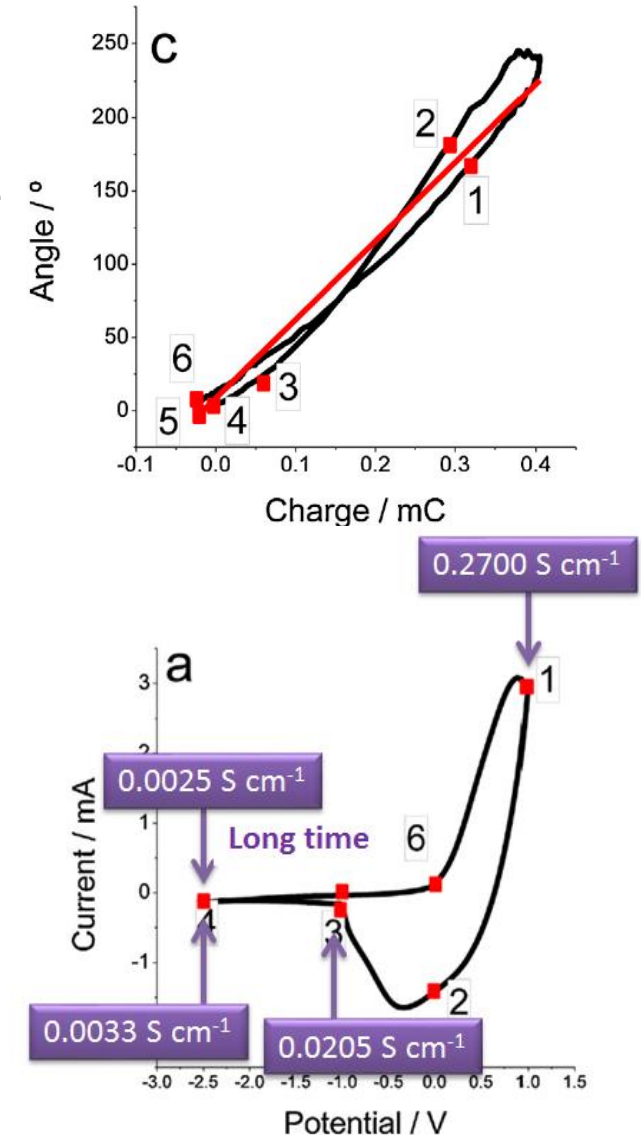
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Controllable through charge

$$\alpha = \alpha_0 + kQ$$

No need of metal attached



Sensing Conducting Polymers



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Artificial Proprioceptive Equation

$$E(t) = E_0 + i_a Z - \frac{\Delta PV}{(1-\alpha)nF} + \frac{RT}{(1-\alpha)nF} \left(\ln \left(\frac{\omega}{KFV} \right) - a \ln[A^-] - b \ln \left([Pol^*]_{initial} - \frac{\alpha}{KFV} \right) - \ln k_0 \right)$$



Current
Sensor



Mechanical
Sensor



Thermal
Sensor



Angular rate
 ω



Chemical
Sensor



Angle
 α



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Objectives



Aim of the Project

Simultaneous sensing-actuators (proprioceptive muscles)

Theoretical Model for Artificial Proprioception : Proprioceptive Equations

Design Fabrication and control of different tools and robotic components



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Work Plan



Work Plan

1st year

- State of art of the field
- Learning of the electrochemical techniques used to generate and characterize films of conducting polymers.
- Learning of the techniques employed to study the suitability of the different materials for their used as artificial muscles.
- Study of different materials assessing their possible used as artificial muscles.

2nd year

- Choice of a material to develop a control system.
- Developing of a control system
- Developing of a methodology to compare different materials and their possible use as artificial muscles
- Improvement of the theoretical model for artificial proprioception

3rd year

- Developing of a patentable sensing-actuator prototype
- Writing and presentation of the thesis.



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Current Results



Publications

- “Biomimetic reaction-driven conformational movements sense working electrochemical energy: Sweep rate influence” accepted by Electrochemical Acta. Authors: T.F. Otero, V.H Pascual, J.G. Martinez, L. Valero.
- “Construction and coulodynamic characterization of PPy-DBS-MWCNT/tape bilayer artificial muscles” accepted by RSC Advances. Authors: T.F. Otero, J. Schumacher, V.H Pascual.



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Thank you!!