

Accepted Manuscript

Bio-inspired soft robotics: Material selection, actuation, and design

Stephen Coyle, Carmel Majidi, Philip LeDuc, K. Jimmy Hsia

PII: S2352-4316(17)30231-6
DOI: <https://doi.org/10.1016/j.eml.2018.05.003>
Reference: EML 369

To appear in: *Extreme Mechanics Letters*

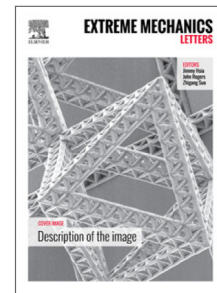
Received date: 27 December 2017

Revised date: 17 April 2018

Accepted date: 22 May 2018

Please cite this article as: S. Coyle, C. Majidi, P. LeDuc, K.J. Hsia, Bio-inspired soft robotics: Material selection, actuation, and design, *Extreme Mechanics Letters* (2018), <https://doi.org/10.1016/j.eml.2018.05.003>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Bio-inspired Soft Robotics: Material Selection, Actuation, and Design

Stephen Coyle^a, Carmel Majidi^a, Philip LeDuc^a, and K. Jimmy Hsia^{a,b,*}

^aDepartment of Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA

^bDepartment of Biomedical Engineering, Carnegie Mellon University, Pittsburgh, PA

* Corresponding author, kjhsia@cmu.edu

Keywords:

Morphology
 Biomimetic
 Pneumatic Artificial Muscle
 (PAM)
 Material Jamming
 Bio-Hybrid
 Mechanical Dynamics
 Actuation
 Embodied Intelligence
 Degrees of Freedom
 Compliance
 Storage Modulus
 Loss Modulus
 Energy Density

ABSTRACT

Animals exploit the deformability of soft structures to move efficiently in complex natural environments. These soft structures are inherently compliant and enable large strains in components not typically found in robotics. Such capabilities have inspired robotic engineers to incorporate soft technologies into their designs. One goal in soft robotics is to endow robots with new, bioinspired features that permit morphologically adaptive interactions with unpredictable environments. Here, we review three key elements of bioinspired soft robots from a mechanics vantage point, namely, materials selection, actuation, and design. Soft materials are necessary for safe interaction and overall actuation of bio-inspired robots. The intrinsic properties of materials in soft robots allow for an “embodied intelligence” that can potentially reduce the mechanical and algorithmic complexity in ways not possible with rigid-bodied robots. Finally, soft robotics can be combined with tissue engineering and synthetic biology to create bio-hybrid systems with unique sensing, dynamic response, and mobility. Bioinspired soft robots have the ability to also expedite the evolution of co-robots that can safely interact with humans.

Contents

1. Introduction.....	2
2. Bio-Inspired Material Selection.....	3
3. Bio-Inspired Actuation.....	5
4. Bio-Inspired Design.....	7
5. Concluding Remarks.....	11
References.....	12

Download English Version:

<https://daneshyari.com/en/article/7170563>

Download Persian Version:

<https://daneshyari.com/article/7170563>

[Daneshyari.com](https://daneshyari.com)