

Table of Contents

Committees

Preface

CHAPTER 1: ALGORITHMS, MECHANISMS AND STRUCTURES IN NATURE AS INSPIRATION TO MIMICKING

Spider Silk as an Inspiration for Biomimicking

J. Pérez-Rigueiro, M. Elices Calafat, G.R. Plaza, G.V. Guinea, P. Corsini and E. Marsano

1

Approaches to the Construction of the Minimal Cell

P. Stano

10

Flight Control of an Insect

S. Sunada

20

Investigating the Thrust Production of a Myliobatoid-Inspired Oscillating Wing

K.W. Moore, W. Smith, J.M. Hester, W. Chang and H. Bart-Smith

25

Deployable Structures in Plants

H. Kobayashi and K. Horikawa

31

A Bat-Wing Aircraft Using the Smart Joint Mechanism

E. Leylek, J. Manzo and E. Garcia

41

Analysis and Optimization-Based Synthesis of Compliant Mechanisms

A. Hasse and L.F. Campanile

47

CHAPTER 2: BIOMIMETIC MATERIALS

Fractals to Model Hierarchical Biomaterials

A. Carpinteri, P. Cornetti, N.M. Pugno and A. Sapora

54

New Fabrication Process of Nano–Composites by Biomimetic Approach

M. Okamoto, E. Iwai, H. Hatta, H. Kohri and I. Shiota

60

Gecko Inspired Suit Could Have you Climbing the Wall

N.M. Pugno

66

Effective Impregnation of SiO₂ Sol-Gel Solution in Pine Wood and Following Gel

Localization in Free Cell Volume

J. Locs, L. Berzina-Cimdina, A. Zhurinsh and D. Loca

72

CHAPTER 3: BIO-INSPIRED SENSORS AND ACTUATORS

Bioelectronic Detection Schemes for Biomedical and Environmental Sensing

A. Offenhäusser, S. Ingebrandt, M. Pabst and F. Sommerhage

78

Towards Biocompatible Sensing Devices: An IPMC Based Artificial Vestibular System

C. Bonomo, L. Fortuna, S. Graziani, M. La Rosa, D. Nicolosi and G. Sicurella

85

Double Layer Sensor Reproducing Perception Dynamics of Olfactory Cells

A. Macagnano, E. Zampetti, B.R. Pistillo, A. Bearzotti, S. Pantalei and R. d'Agostino

91

Determining the Binaural Signals in Bat Echolocation

T. Papadopoulos, R. Allen and S. Haynes

97

Generating Bio-Analogous Recognition of Artificial Materials – Sensors and Electronic Noses for Odours

P.A. Lieberzeit, A. Rehman, B. Najafi and F.L. Dickert

103

A pH-Activated Biomimetic Actuator Derived from McKibben Artificial Muscle Structure

B. Tondu, R. Emirkhanian, S. Mathé and A. Ricard

108

Mining Smartness from the Hydraulic System of Spiders: A Bioinspired Actuator for Advanced Applications

C. Lira, C. Menon, K. Kianfar, F. Scarpa and M. Mani

114

CHAPTER 4: BIOLOGICALLY INSPIRED SYSTEMS AND ROBOTICS

Towards <i>In Vivo</i> Nanomachines	120
E. Friedrichs, R. Jungmann, A. Tsokou, S. Renner and F.C. Simmel	
Neuromimetic Robots Inspired by Insect Vision	127
N. Franceschini, S. Viollet, F. Ruffier and J. Serres	
CPG Control of a Tensegrity Morphing Structure for Biomimetic Applications	137
T.K. Bliss, T. Iwasaki and H. Bart-Smith	
Biorobots, Nonlinear Dynamics and Perception	143
P. Arena, D. Lombardo and L. Patanè	
Anthropomorphic Talking Robot Based on Human Biomechanical Structure	153
K. Fukui, Y. Ishikawa, E. Shintaku, M. Honda and A. Takanishi	
Cyborg MAVs Using Power Harvesting and Behavioral Control Schemes	159
T. Reissman and E. Garcia	
Multi-UUVs Team Line Formation Control by a Behaviour-Based Method with Fuzzy Logic Adapters	165
Y. Hou and R. Allen	
Fabrication and Evaluation of Biomimetic Jellyfish Robot Using IPMC	171
S.W. Yeom and I.K. Oh	
The Nano and Micromanipulators Based on Magnetic Bacterium	177
M. Ignat and G. Zarnescu	

CHAPTER 5: BIOMIMETIC FLOW CONTROL IN AQUATIC SYSTEMS AND ITS APPLICATION TO BIOINSPIRED AUTONOMOUS UNDERWATER VEHICLES

Vortex Method for the Analysis of Complex, Unsteady and Vortical Flows around a Swimming Fish	183
K. Kamemoto and A. Ojima	
Understanding the Hydrodynamics of Swimming: From Fish Fins to Flexible Propulsors for Autonomous Underwater Vehicles	193
M. Bozkurttas, J. Tangorra, G. Lauder and R. Mittal	
Reverse Engineering of Self-Propelled Anguilliform Swimmers	203
S. Kern, P. Chatelain and P. Koumoutsakos	
An Exploration of Passive and Active Flexibility in Biolocation through Analysis of Canonical Problems	212
J.D. Eldredge, M. Wilson and D. Hector	
Modeling the Dynamics of Human Swimming	220
M. Nakashima	
Geometric Mechanics and Aquatic Locomotion through Vortex Shedding	229
S.D. Kelly	
Vortex Rings in Bio-Inspired and Biological Jet Propulsion	237
P.S. Krueger, A.A. Moslemi, J.T. Nichols, I.K. Bartol and W.J. Stewart	
Fluid-Structure Interactions in Pelagic Trawls and Probable Consequences for the Selectivity of the Fishing Gear	247
M. Paschen, H.J. Winkel and H. Knuths	
Hammerhead - A Vision Guided AUV	257
R.L. Allwood	
Robustness of Biomimetic Underwater Vehicles under Disturbances	266
N. Kato and H. Suzuki	