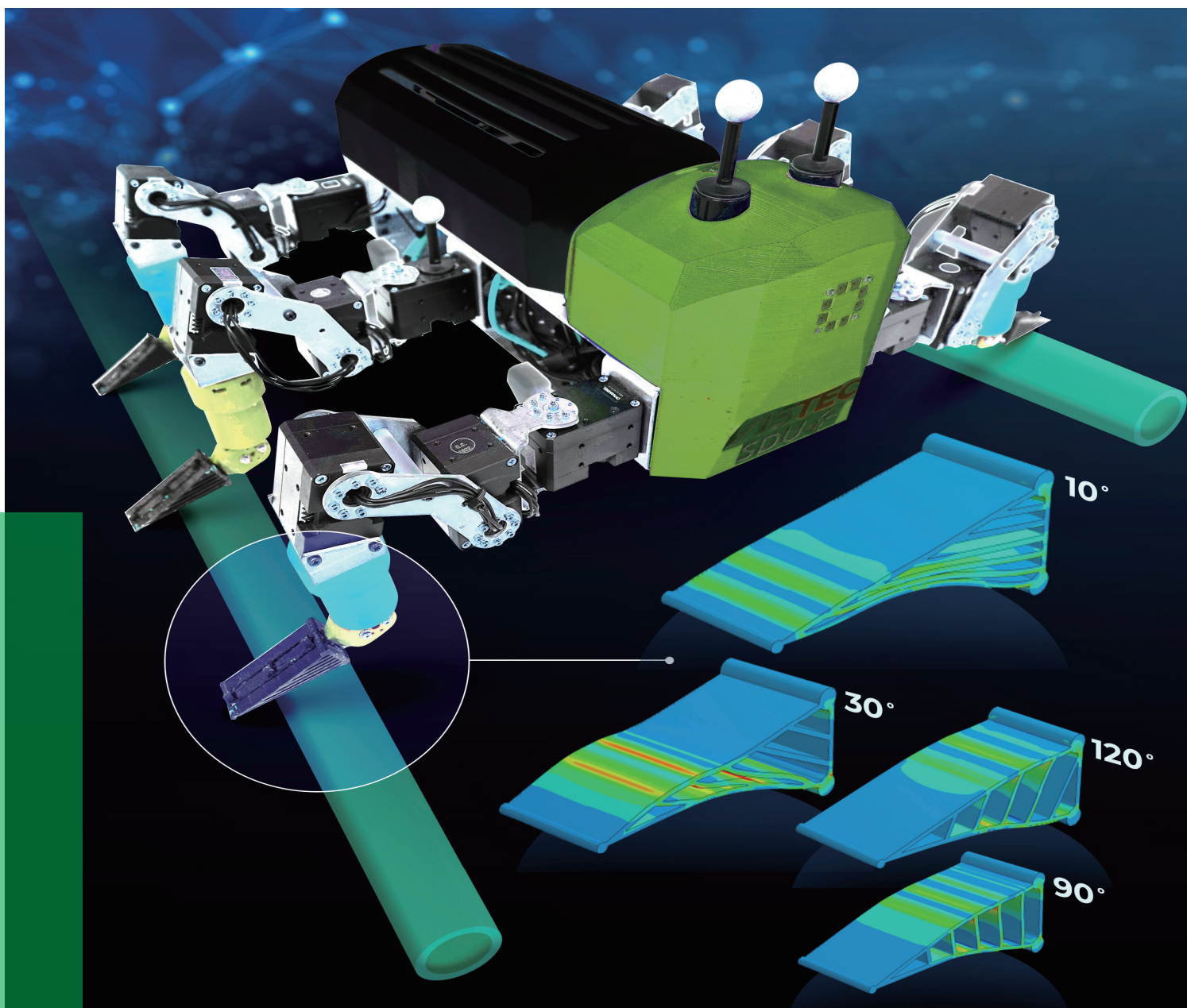




NEWSLETTER

International Society of Bionic Engineering

Volume 11, Issue 1, 2022



Contents

1-Members

03 Ille C. Gebeshuber

05 Zhihui Zhang

2-News and Events

07 The Fourth Online Academic Forum on "Frontiers in Bionic Engineering"

08 2022 International Bionic Award

09 Call for Nominations for the Fellow Members of ISBE

10 Introduction to the Journal of Bionic Engineering (JBE)

12 Case Study at ISBE Website

13 Call for Papers – Droplet (Wiley)

13 Welcome to visit the special issue of Interface Focus - Coronavirus and surfaces

Cover Photo: Insect-inspired Robot Foot Design for Energy-Efficient Robot Locomotion, cover © Poramate Manoonpong.

3-Highlights of Research

14 Insect-inspired Robot Foot Design for Energy-Efficient Robot Locomotion

15 Sustainability Assessment of the Anthropogenic System in Panama City: Applying Biomimetic Strategies towards Regenerative Cities

16 Enhancement of Dropwise Condensation by Engineering Nano/Micro/Macro Hierarchical Surfaces: Inspiration from Nature for Efficient Water Collection

17 Interdisciplinary Trends: Artificial-Intelligence-Assisted Bio-Inspired Liquid Gating Membrane

18 A novel bio-inspired mechanism to elucidate the movement flexibility of the honeybee abdomen driven by muscles

20 A Bionic Stratospheric Airship Inspired by *Physalia physalis*

4-Upcoming Activities

21 ICBE 2022

23 IEEE ARM 2022

Ille C. Gebeshuber

Institute of Applied Physics, Vienna University of Technology

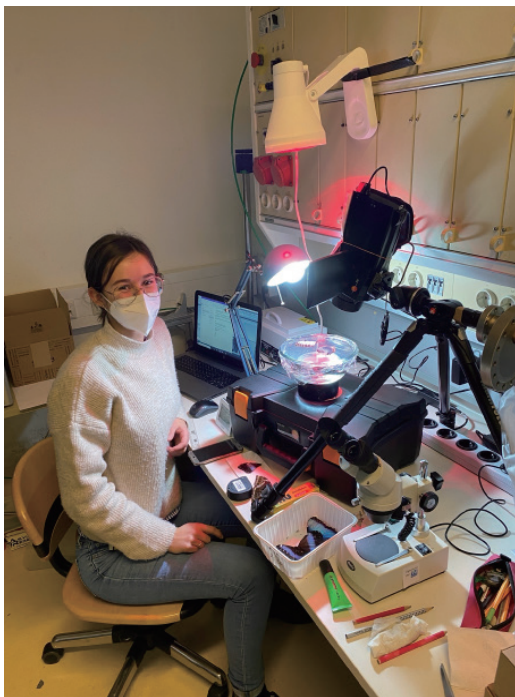


(c) Fotostudio Wilke, 1010 Vienna, Austria

Ille C. Gebeshuber is Associate Professor at the Institute of Applied Physics at the Vienna University of Technology, Austria, Europe, where she also graduated and completed her Ph.D. in the technical sciences. In 1999, she undertook postdoctoral training in scanning probe microscopy and biomimetics at the

University of California, Santa Barbara, CA, USA, and soon after she returned to Austria to her home university, working on ion surface interactions, tribology and (bio-) nanotechnology. From 2009 to 2015, she joined the Institute of Microengineering and Nanoelectronics at the National University of Malaysia as Professor.

During her expeditions, together with students and scientific colleagues from culturally diverse backgrounds and expertise, she learned from the rainforest how one can identify well-adapted structures, materials and processes in living Nature. This inspired her to apply abstracted biological principles for solving technological problems for humans to face major challenges in a safe and sustainable way. In 2017, she was elected Austrian of the Year in the category “Research”. Her research focuses on nanotechnology and biomimetics, and takes a multidisciplinary approach, from biology and engineering to the fine arts and the social sciences. Science outreach and mentoring young talent in Europe and in Asia are important to her. Her public science books on solutions from the rainforest and their impact



Student Viola Kaser investigating passive radiative cooling properties of tropical butterfly wings.



Ready to explore the rainforest in Tanjung Tuan in Malaysia with pupils from various local schools.

development of a finite element model for the biomimetic optimization of stretch foils. The goal of the antibacterial structure research is to develop functional surfaces against multidrug-resistant bacteria, that can be used on door handles, wall coatings and surgical instruments. The butterfly research shall inspire façade paints as well as coatings for computer parts and spacecrafts that have passive radiative cooling as functional principle, replacing inadequate out-of-date current technologies. The research on the stretch foils is embedded in the “Production of the Future” research, technology and innovation initiative of the Austrian federal ministry for climate action, environment, energy, mobility, innovation and technology. The objective is to reduce the use of stretch wrap based on fossil raw materials for packaging and securing of load carriers by 30 % by 2025 compared to 2016.

Ille C. Gebeshuber is a founding member of the ISBE, and a global advocate of biomimetics.

on the future of humankind are widely read.

Under her guidance students investigate diverse themes such as the development of antibacterial structures inspired by cicada wings, passive radiative cooling inspired by tropical butterflies, the experimental investigation of bio-based plastic films and the



Science outreach 2022 in the German Museum in Munich, the world's largest museum of science and technology.



Zhihui Zhang

***General Secretary of the ISBE**

***Chairman of Technical Committee Biomimetics at ISO (ISO/TC 266)**

***Professor of Jilin University, China**

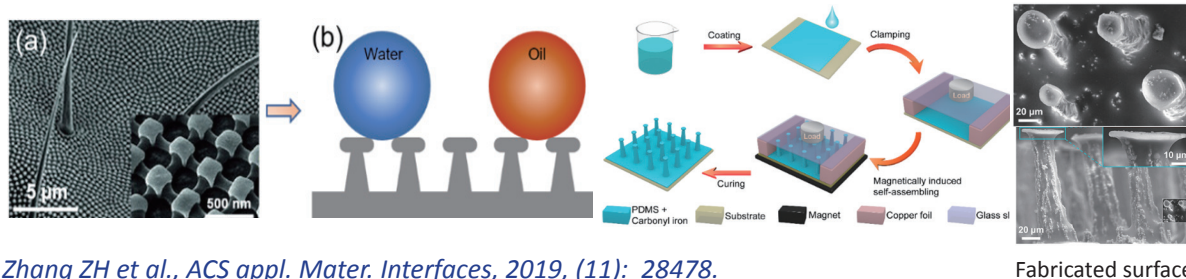
Zhihui Zhang is a professor at the Key Laboratory of Bionic Engineering of Ministry of Education, Jilin University. He is a winner of the National Science Fund for Distinguished Young Scholar. Prof. Zhang received his PhD degree in Materials Processing Engineering from Jilin University in 2007. Afterwards, he was selected as associate professor of Jilin University. As a visiting scholar, he had worked in the University of Manchester in 2014, and then was granted as a professor in the key lab.

Prof. Zhang's representative research including the following three aspects:

design, preparation and tribology study of bionic functional surfaces; bionic additive manufacturing, and bionic prevention and repairing techniques of mechanical surfaces as shown in the following figures.

During the past years, he has successively presided over 15 national projects, including National Key R&D Program, Key Program of National Natural Science Foundation, National 863 Plan, etc. Prof. Zhang has been honored with various awards and prizes, e.g. the second prize of the "State Technological Invention Award" and the first prize of the "Science and Technology Award of Jilin Province". He has published

Multistimuli-responsive microstructured superamphiphobic surfaces with large-range, reversible switchable wettability for oil inspired by the re-entrant structures of springtails.



Zhang ZH et al., *ACS appl. Mater. Interfaces*, 2019, (11): 28478.

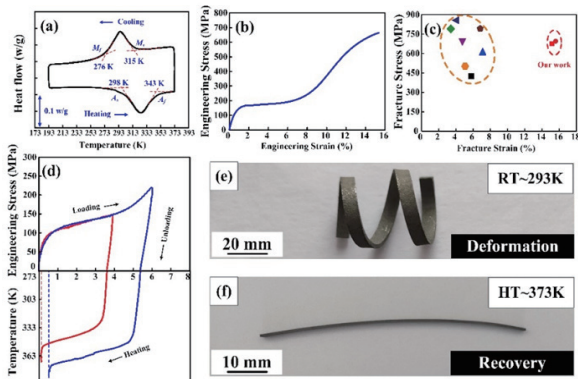
Figure 1: Based on bionic prototypes, carrying out the researches concentrated on the theory and technology of bionic tribology, dedicated to excellent drag reduction, wear resistance, fatigue resistance and anti-erosion properties

nearly 120 papers in international academic journals, and authorized more than 30 national invention patents.

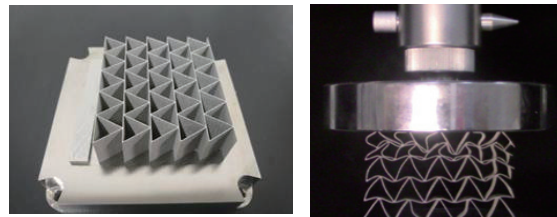
Prof. Zhang is currently the director of the national international science and technology cooperation base of bionic engineering and vice

dean of the College of Biological and Agricultural Engineering in Jilin University, while serving as the Chairman of the Technical Committee Biomimetics at ISO (ISO/TC 266) and General Secretary of the International Society of Bionic Engineering (ISBE).

Tensile deformation has been increased by 117% by additive manufacturing(AM) the bionic NiTi structural materials

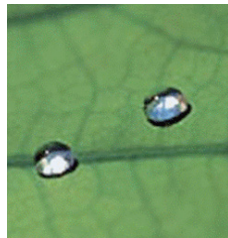


Our result: 15.2%
General report: ~7%



Zhang ZH*, et al. *Applied Materials Today*, 2020 (19) 100547.

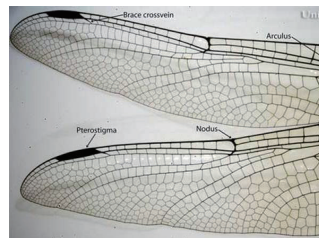
Figure 2. Based on bionic prototypes and bionic coupling theory, he engages in researches of bionic structure design and additive manufacturing for the metallic materials, intelligent materials, etc. to gain special functions and desired performances.



Self-cleaning ability of lotus leaf



Bionic anti-adhesion mold



Veins of dragonfly wings



Bionic anti-adhesion mold

Figure 3. To solve the problems of unsatisfied wear and fatigue resistance of metals, bionic anti-wear and anti-fatigue techniques were developed.

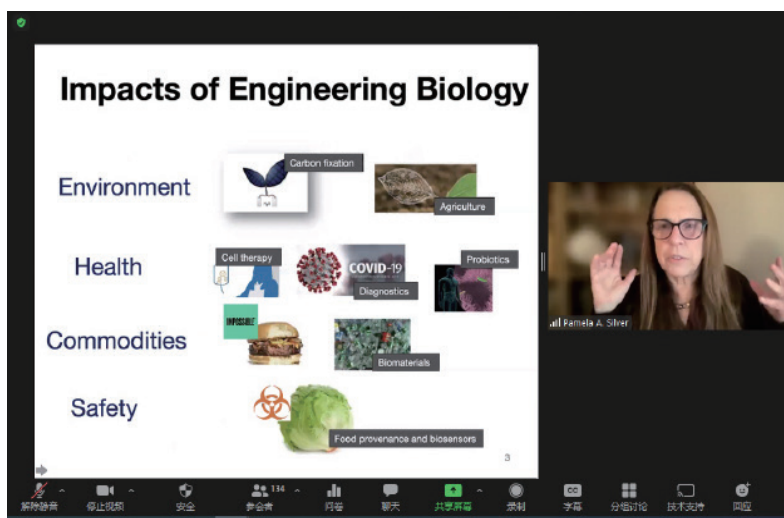
Call for Newsletter Submissions

ISBE Secretariat is always calling for news and ideas among our members, if there is any information you would like to include in a future edition of newsletter, please feel free to contact us.

Email: gyue@isbe-online.org Tel/ Fax: +86-431-85166507

Address: Dingxin Building, Jilin University, 2699 Qianjin Street, Changchun P. R. China

The Fourth Online Academic Forum on "Frontiers in Bionic Engineering"



splitting, which was cultured with the bacteria *Ralstonia eutropha*. The conversion efficiency of this artificial system is much higher than that of natural photosynthesis. This type of "bionic leaf" may start a new "green revolution", which is expected to solve the long-existing energy problem, so as to realize the sustainable development of human society.

Nearly 200 scholars and graduate students from over 50 universities and research institutes around the world attended the forum online.

"Frontiers in Bionic Engineering" online academic forum is a series of academic activities initiated by the Youth Commission of the ISBE. It aims to establish an academic exchange platform for scholars in bionics around the world to share their latest research ideas and achievement and further promote the innovation cooperation as well as the development of bionic science. The activity has gained great attention and support of specialists, scholars and graduate students, and received enthusiastic responses.

On 10th December, the Fourth Online Academic Forum on "Frontiers in Bionic Engineering" was successfully held via a Zoom conference, which was hosted by the International Society of Bionic Engineering (ISBE), the Bionic Science and Engineering Institute of Jilin University and the International Collaboration Center of Bionic Sci-Tech at Weihai Institute for Bionics-Jilin University. Prof. Pamela A. Silver from Harvard Medical School and the Wyss Institute for Biologically Inspired Engineering at Harvard University was invited to share the latest research progress of her group in the field of designing biology for health and sustainability. The forum was presided over by Prof. Zhenning Liu, Dean of the Bionic Sciences and Engineering Institute of Jilin University.

The engineering of biology presents infinite opportunities for therapeutic design, diagnosis, prevention of disease and solutions to environmental problems. Inspired by photosynthesis in nature, Prof. Pamela A. Silver and her team had developed an efficient artificial photosynthesis system based on a new Co-P catalyst for water





International Society of
Bionic Engineering

2022 International Bionic Engineering Award



The ISBE offers International Bionic Engineering Award at each triennial conference to honour and encourage the society members for their prominent contributions and achievements in the field of bionic engineering.

The Award includes three categories:

- 1) Outstanding Contribution Award: Two winners, each one will be awarded 30,000 RMB;
- 2) Outstanding Youth Award: Two winners aged under 40 years old, and each one will be awarded 10,000 RMB.
- 3) Outstanding Student Award: Two winners aged under 30 years old, and each one will be awarded 5,000 RMB.

Qualifications

- 1) Outstanding Contribution Award and Outstanding Youth Award:
 - a. The winners shall have contributed remarkable research achievements in bionic engineering;
 - b. The winners shall have made great progress in scientific research, community service, technology transfer, etc in bionic engineering;
 - c. The winners shall have made a prominent contribution to the promotion of science and technology, international communication and collaboration, etc in bionic engineering.
- 2) Outstanding Student Award:
 - a. The winners shall be the students majored in a bionic academic discipline;
 - b. The winners shall show outstanding scientific and research qualities;
 - c. The winners shall have made remarkable research achievements in bionic engineering.

Now nominations are invited for this Award, and there are three methods of nominating candidates:

- 1) Self-recommendation;
- 2) Recommended by another member;
- 3) Recommended by a group of colleagues.

Common ways of submitting nominations are e-mail (xmtian@isbe-online.org or secretariat@isbe-online.org). **The deadline for submission of nominations is April 30, 2022**, unless otherwise indicated.

More Information: <https://www.isbe-online.org/?ui=english&mod=info&act=view&id=4550>



Call for Nominations for the Fellow Members of ISBE

The fellow members of ISBE refer to those who have made great achievements in the field of bionic engineering and made significant contributions to the development of the Society. The ISBE carried out the evaluation of fellow members respectively in 2014 & 2019, and 10 individual members in total have been selected as fellows.



Nominations for Fellow Members in 2022 are now being accepted!

Qualifications:

- 1) The candidate will have been a member of the ISBE for at least three years.
- 2) The candidate will have promoted the development of bionic engineering and shall have contributed significantly to the advancement or application of bionic engineering.
- 3) The candidate will have taken an active role in the activities of the ISBE and will have made significant contributions to the development of the ISBE.

Nomination methods:

a) Self-nomination:

Any Ordinary Member is eligible to nominate his/her self for Fellowship of the ISBE, and must have two (2) supporting nominators.

b) Nomination by others:

Three (3) Ordinary Members of the ISBE may recommend a candidate for Fellowship, and explanatory materials for recommendation also need to be provided.

The Members shall submit the **Fellowship Application Form** together with the **recommendation letters** to the ISBE Secretariat. The Executive Board of Directors is in charge of the evaluation, and the final result will be announced on the official website and Newsletter of the ISBE.

The ISBE will present the Certificate of Fellowship to the successful candidate at the opening ceremony of **ICBE 2022 (September 15-18, 2022, Wuhan, P. R. China)**.

- ✓ The Application Form can be downloaded from the ISBE website: <https://isbe-online.org/?ui=english&mod=info&act=view&id=4481>
- ✓ Common way of submitting nominations is e-mail : xmtian@isbe-online.org
- ✓ The deadline for submission of nominations is **April 30, 2022**, unless otherwise indicated.



Introduction to the *Journal of Bionic Engineering* (JBE)

The *Journal of Bionic Engineering* (JBE) is a single-blind peer-reviewed journal that publishes original research papers and reviews that apply the knowledge learned from nature and biological systems to solve real engineering problems. The topics that JBE covers include but are not limited to:

(1) Mechanisms, kinematical mechanics and control of animal locomotion, development of mobile robots with walking (running and crawling), swimming or flying abilities inspired by animal locomotion.

(2) Structures, morphologies, composition and physical properties of natural and biomaterials; fabrication of new materials mimicking the properties and functions of natural and biomaterials.

(3) Biomedical materials, artificial organs and tissue engineering for medical applications and rehabilitation equipment.

(4) Development of bioinspired computation methods and artificial intelligence for engineering applications.

JBE aims to provide a platform for the communication and dissemination of scientific knowledge and novel ideas in the field of bionic science and engineering.

(1) Applies insight from nature and biological systems to solve bionic engineering challenges

(2) Offers research on kinematical mechanics and control of animal locomotion

(3) Explores bioinspired computation methods and artificial intelligence

Video Abstract of issue 6: <https://mp.weixin.qq.com/s/Qo7djzQkRXXRJsR5uPpFWDw>

Journal's website:

<https://www.springer.com/journal/42235/>



Journal of Bionic Engineering

Volume 18, issue 6

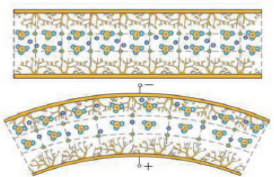
Table of Contents

- A Review of Research on the Mechanical Design of Hoverable Flapping Wing Micro-Air Vehicles
- A Brief Review on Aerodynamic Performance of Wingtip Slots and Research Prospect
- Biomimetic Quadruped Robot with a Spinal Joint and Optimal Spinal Motion via Reinforcement Learning
- Development of a Bird-like Flapping-wing Aerial Vehicle with Autonomous Take-off and Landing Capabilities
- Design and Experiment of a Deformable Bird-inspired UAV Perching Mechanism
- Study on Decentralization of Spherical Amphibious Multi-robot Control System Based on Smart Contract and Blockchain
- Quantitative Progress Evaluation of Post-stroke Patients Using a Novel Bimanual Cable-driven Robot
- Conceptual Method of Temperature Sensation in Bionic Hand by Extraordinary Perceptual Phenomenon
- Design, Characterization and Optimization of Multi-directional Bending Pneumatic Artificial Muscles
- Application of Novel Design Bone Grafting for Treatment of Segmental Acetabular Rim Defects During Revision Total Hip Arthroplasty
- Electrospun Scaffold of Collagen and Polycaprolactone Containing ZnO Quantum Dots for Skin Wound Regeneration
- Modification of the Micro Arc-oxidized Ti Surface for Implant Applications
- Silk Fibroin and κ -Carrageenan Composite Films Containing Zinc-doped Bioactive Glass for Wound Closure
- Critical Role of Silicon in Directing the Bio-inspired Mineralization of Gelatin in the Presence of Hydroxyapatite
- Flexural and Dynamic Mechanical Properties of Alkali-Treated Coir/Pineapple Leaf Fibres Reinforced Polylactic Acid Hybrid Biocomposites
- Brain-like Intelligent Decision-making Based on Basal Ganglia and Its Application in Automatic Car-following
- An Improved Pigeon-Inspired Optimization for Multi-focus Noisy Image Fusion
- An Efficient Gait-generating Method for Electrical Quadruped Robot Based on Humanoid Power Planning Approach

Case Study at ISBE Website

Bionic Ionic Sensor Inspired by Biological Skin Using Ionic Polymer

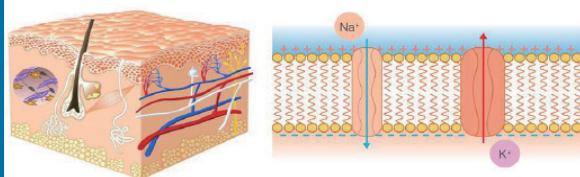
From human skin to ionic sensor



The case was provided by the Individual Member of ISBE (PM594)

1. Biological Prototype

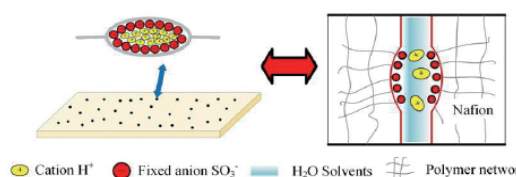
Human skin responds to a variety of stimuli, such as **pressure, friction, humidity, temperature, etc.**



From a microscopic point of view, signal transmission is achieved through **ion migration** between cells.

2. Design and Processing

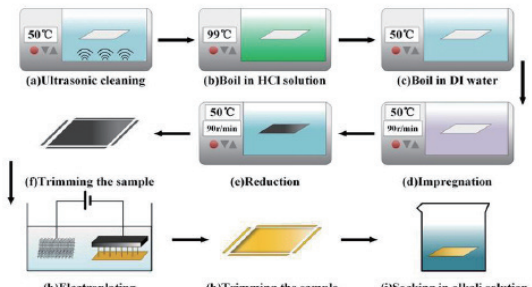
Nafion is a kind of cation exchange membrane. The anions inside the polymer are fixed by network, and the **cations can immigrate freely in the nanochannel**. It is similar to the mechanism of skin perception.



Legend: Cation H^+ , Fixed anion SO_3^- , H_2O Solvents, Polymer network

2. Design and Processing

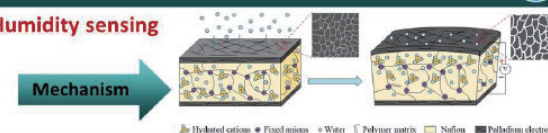
An IPMC sensor is prepared by plating metal electrodes on both sides of a Nafion membrane.



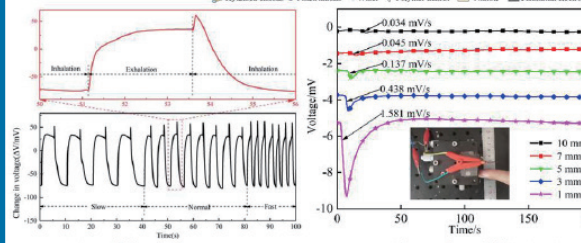
3. Achievements and Application

Humidity sensing

Mechanism



Legend: Hydrated cations, Fixed anions, Water, Polymer matrix, Nafion, Palladium electrode

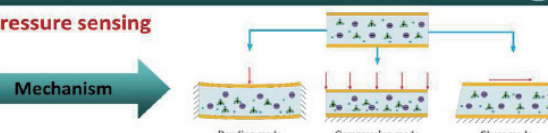


Breathing test **Finger humidity test**

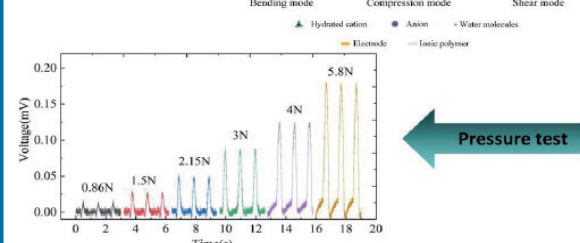
3. Achievements and Application

Pressure sensing

Mechanism



Legend: Hydrated cation, Anion, Water molecules, Electrode, Ionic polymer



Pressure test

Call for Case Study Submissions

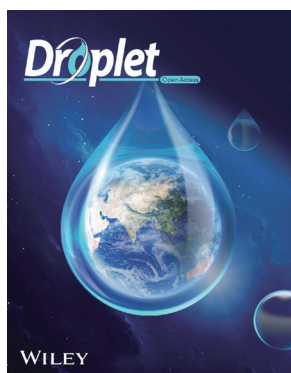


ISBE is calling for case study submissions now. You can contact Ximei Tian for the template of case study. Your kindness and consideration will be appreciated. We look forward to receiving your submissions!

Email: xmtian@isbe-online.org
Tel: +86-431-85166507

Call for Papers – Droplet (Wiley)

Droplet is a peer-reviewed international and cross-disciplinary open access journal to publish reviews, research papers, and editorials that involve droplets, bubbles and related topics. The journal covers the design, synthesis, fabrication, characterization, manipulation, control, application and commercialization of structures, devices and systems that involve droplets and related objects from microscopic to macroscopic scales.



Droplet aims to provide an excellent platform for the dissemination of the cutting-edge research results in the general area of droplet & bubble. All manuscripts are subject to critical, anonymous peer review.

Why publish in Droplet?

- First journal to fully devote to research on droplets/bubbles.

- Droplet will be an important platform for researchers in the 'Droplets/bubbles' related research fields including Physics, Chemistry, Engineering, Materials Science, Bionics, and Biology and others. It will provide a hub for high-level academic communications by connecting researchers all over the world.

- Benefit from a diverse and esteemed editorial board. All members are internationally active and renowned experts in this field.

- Open access means that your research will be available online to everyone, resulting in more shares, downloads, and citations.

- Publish your research at no direct cost to you. All APCs are waived until 2025.

Editors-in-Chief

Luquan Ren, Jilin University, China

Chang-Jin "CJ" Kim, University of

California, Los Angeles (UCLA), USA

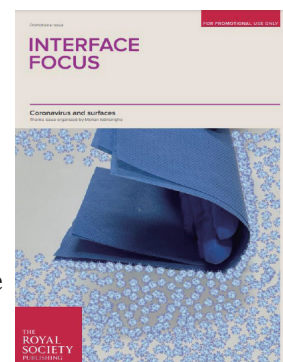
Submission online: <https://mc.manuscriptcentral.com/droplet>

Journal website: <https://onlinelibrary.wiley.com/journal/27314375>

Welcome to visit the special issue of Interface Focus - Coronavirus and surfaces

Royal Society Publishing has recently published a special issue of Interface Focus entitled Coronavirus and surfaces organised by Mohan Edirisinghe. The articles can be accessed directly at <https://royalsocietypublishing.org/toc/rsfs/2022/12/1> There is also a blog post at <https://royalsociety.org/blog/2021/12/coronavirus-and-surfaces/>

This issue highlights the role of different surfaces in the transmission of the SARS-CoV-2 virus. It has been discovered that the virus can linger on surfaces for a very long time, helping facilitate transfer between people when surfaces are touched. The papers in the special issue shed light on how long the virus can survive on different surfaces and whether we can use this information to tailor surface properties. A Headline Review on "Surface interactions and viability of coronaviruses" in the Journal of The Royal Society Interface in January 2021 will go hand-in-hand with the content of this special issue in defining the materials and products that should be used.



Insect-inspired Robot Foot Design for Energy-Efficient Robot Locomotion

Poramate Manoonpong^{1,2*}, Hamed Rajabi^{3,4}, Jørgen C. Larsen¹, Seyed S. Raoufi⁵, Naris Asawalertsak², Jettanan Homchanthanakul², Halvor T. Tramsen³, Abolfazl Darvizeh⁵, Stanislav N. Gorb³

¹Embodied AI & Neurorobotics Lab, SDU Biorobotics, The Mærsk Mc-Kinney Møller Institute, University of Southern Denmark, Odense, Denmark

²Bio-inspired Robotics & Neural Engineering Lab, School of Information Science & Technology, Vidyasirimedhi Institute of Science and Technology, Rayong, Thailand

³Department of Functional Morphology and Biomechanics, Zoological Institute, Kiel University, Kiel, Germany

⁴Division of Mechanical Engineering and Design School of Engineering, London South Bank University, London, UK

⁵Department of Mechanical Engineering Islamic Azad University, Bandar-e-Anzali, Iran

The achievement, performed by an international research team from University of Southern Denmark, Christian-Albrechts-Universität zu Kiel, London South Bank University, Islamic Azad University, and Vidyasirimedhi Institute of Science and Technology, introduces insect-inspired robot technology that breaks with 25-year-old gripping technology - the result is creating international attention. They use an integrative approach, combining 3D printing with soft material, finite element modeling, and neural control, to 1) manufacture the insect-inspired robot foot/gripper structure with compliance; 2) investigate the effect of the structure under different inner crossbeam angles, different loads, and different cylindrical substrates; and 3) finally demonstrate the use of the novel insect-inspired structure as robot feet for energy-efficient on-pipe locomotion and as robot grippers for fragile object grasping (see, a video of the robot experiments at <https://www.youtube.com/watch?v=QtEAR1LyBp4&t=5s>)

The information of this study is also available at Advanced Science News, [https://www.advancedsciencenews.com/insects-help-](https://www.advancedsciencenews.com/insects-help-robots-gain-better-grip/)



Figure 1: Among other crossbeam angles, the Fin Ray model with nonstandard 10°-inclined crossbeams has a greater contact area to a curved surface and better durability. It can enhance the efficiency of on-pipe robot locomotion. The work has been chosen for the front page of Advanced Intelligent Systems.

robots-gain-better-grip/

The detail content is referred to:

Manoonpong, P., Rajabi, H., Larsen, J.C., Raoufi, S.S., Asawalertsak, N., Homchanthanakul, J., Tramsen, H.T., Darvizeh, A. and Gorb, S.N., 2022. Fin Ray Crossbeam Angles for Efficient Foot Design for Energy - Efficient Robot Locomotion. Advanced Intelligent Systems, 4(1), p.2100133.

Sustainability Assessment of the Anthropogenic System in Panama City: Applying Biomimetic Strategies towards Regenerative Cities

A. Quintero¹, M. Zarzavilla¹, N. Tejedor-Flores¹⁻⁴, D. Mora^{1,3,4} and M. Chen Austin^{1,3,4,*}

¹Research Group Energy and Comfort in Bioclimatic Buildings, Faculty of Mechanical Engineering, Universidad Tecnológica de Panamá, Panama City 0819, Panama;

²Centro de Investigaciones Hidráulicas e Hidrotécnicas (CIHH)

³Centro de Estudios Multidisciplinarios en Ciencias, Ingeniería y Tecnología (CEMCIT-AIP)

⁴Sistema Nacional de Investigación (SNI)

*miguel.chen@utp.ac.pa

The urban metabolism of Panama's metropolitan area was investigated to understand the sustainability problem. Its current sustainability state was obtained by estimating the Green City Index, leading to identify key related problems. With the abstraction of the identified problems, the biomimetic strategy "problem-based approach" was carried out, where different pinnacles inspired by nature were selected for the design of regenerative solutions. A framework was proposed to take advantage of the regenerative potential in Panama City. Using ecosystem services, a set of indicators were developed to measure regeneration at the city scale. Consequently, a SWOT analysis was realized along with a questionnaire by local experts from different fields, showing that the feasible solutions were: arborization, green facades, solar roofs, e-mobility, green corridors, bicycle lanes, sidewalks, and biofilters. This research represents a step towards creating and developing regenerative cities. For more information see: <https://doi.org/10.3390/biomimetics6040064>

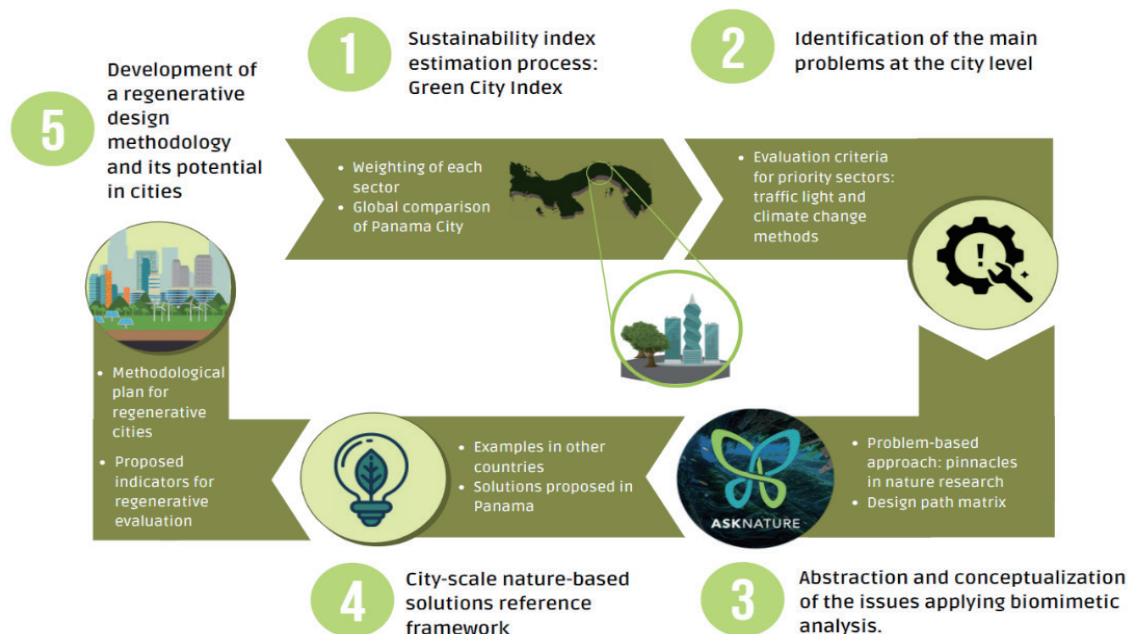


Figure: Overview of the methodology proposed

Enhancement of Dropwise Condensation by Engineering Nano/Micro/Macro Hierarchical Surfaces: Inspiration from Nature for Efficient Water Collection

Yaqi Cheng,^{1,2,3} Xuehu Ma,² Zuankai Wang³

¹Department of Materials Science and Engineering, National University of Singapore, 117580, Singapore

²Institute of Chemical Engineering, Dalian University of Technology, Dalian 116024, China

³Department of Mechanical Engineering, City University of Hong Kong, Hong Kong 999077, China

Worldwide water scarcity is becoming a severe threat to the development of human society in recent decades. Over thousands of years, natural species have evolved intriguing features to gather water from dew to cope with limited water supply, providing us some inspiration for high-performance water collection.

In our recent study, dropwise condensation on a micro-nano hierarchically engineered hydrophilic surface was attained by a liquid suction mechanism. The *Rhacocarpus*-inspired porous surface (RIPS) possesses three-level wettability, which facilitates a

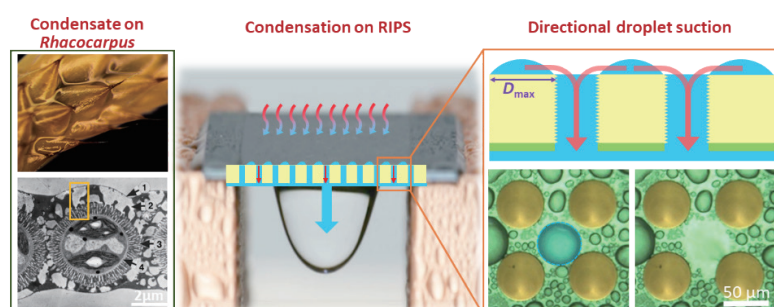


Figure 1: Moss *Rhacocarpus* and *Rhacocarpus*-inspired suction condensation on the micro-nano structured surface RIPS. (<https://doi.org/10.1021/acs.nanolett.1c01928>)

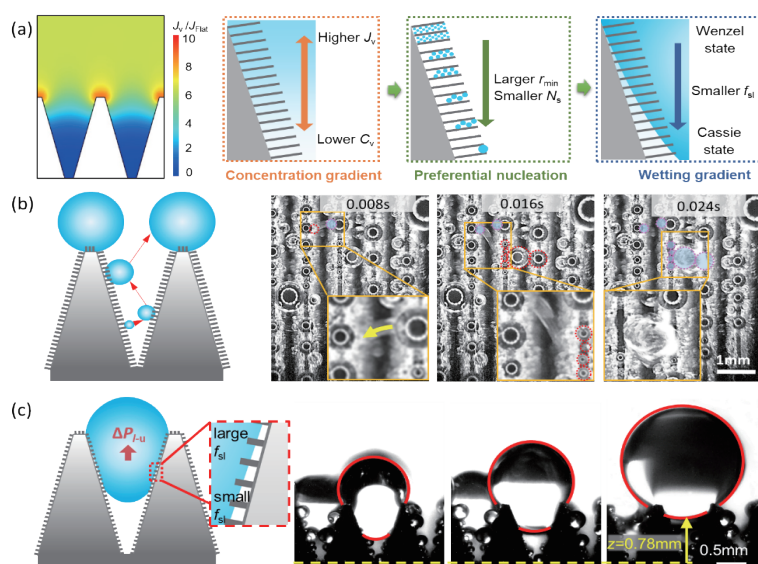


Figure 2: Desert beetle-inspired macro-nano engineered surface for enhancement of water vapor mass transfer, regulation of micro wetting state of condensate and thus droplet dynamic behaviors. (a) Schematic of the mechanism of condensation on macro-nano engineered surface. (b) Droplet jumping relay at small subcoolings. (c) Droplet self-propulsion at large subcoolings. (<https://doi.org/10.1063/1.5082727>; <https://doi.org/10.1016/j.cej.2020.126901>)

rapid, directional, and persistent condensate suction. Consequently, all aspects of advantages such as easy nucleation, frequent droplet removal, and well-defined droplet shedding size were achieved simultaneously.

In addition, millimetric textures inspired by the desert beetles offer another strategy to enhance dropwise condensation. The macro-textured groove arrays promote water vapor mass transfer at the top and prohibit successive nucleation at the bottom. Endowed with such an induced-wetting gradient, small droplets can undergo the relay jumping departure and large droplets exhibit self-propulsion to rapidly detach from the surface.

These work not only to enrich the fundamental understanding of how the hierarchical structure and surface property regulate wetting behaviors, but also provide new design routes for the development of engineered materials towards energy-water nexus applications.

Interdisciplinary Trends: Artificial-Intelligence-Assisted Bio-Inspired Liquid Gating Membrane

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As a new kind of structural material, liquid gating membrane (LGM) is undergoing continuous development and optimization for different applicable scenarios. To address the long-term high consumption caused by traditional "trial and error", artificial intelligence technology is employed for design and test of LGM, by effectively integrating material structure, composition and performance.



Most recently, Hou group proposed an Active Kriging Machine Learning Method to predict the mechanical and rheological performance of liquid gating system, thus guiding and accelerating the development of LGM. Compared to classical sequential model, which is still restricted by poor selection strategy of training samples, this adaptive approach is focused on local accuracy near the most sensitive search region, minimizing the size of experimental tasks.

Other branches will be also developed to suit for the novel artificial intelligence assisted system, including regression method, neural networks, support vector machine and clustering algorithm, thus opening up a new platform

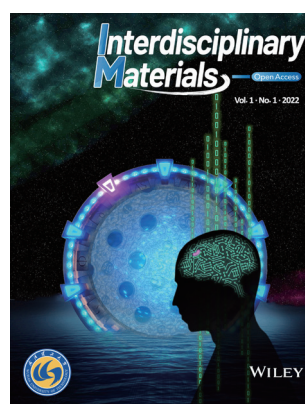


Figure. The cover article of the inaugural issue of *Interdisciplinary Materials*, which embodies the interdisciplinary concept of artificial-intelligence-assisted bio-inspired liquid gating membrane.

to design and study bio-inspired liquid gating technology. The result has been published in *Interdisciplinary Materials* as a cover article of the inaugural issue. For more information, please see <https://xuhougroup.xmu.edu.cn/>. Reference:

M. Zhang, Y. Jing, J. Zhang, et al. Performance Prediction of Magnetorheological Fluid-Based Liquid Gating Membrane by Kriging Machine Learning Method. *Interdisciplinary Materials* 2022,1,1-13. doi:10.1002/idm2.12005

S. Yu, L. Pan, Y. Zhang, et al. Liquid Gating Technology. *Pure and Applied Chemistry* 2021,93, 1353-1370.

X. Hou. Liquid Gating Membrane. *National Science Review* 2020, 7,14-16.

A novel bio-inspired mechanism to elucidate the movement flexibility of the honeybee abdomen driven by muscles

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Honeybee abdomens exhibit amazing movement flexibility according to different environments after billions of years of evolution. Natural movement flexibility, such as the wagging movement to gather information from food sources, rotating movement to control flight stability, and the swinging movement to dissipate the residual flying energy, is contributed to by cooperation from the abdominal muscle group. Therefore, this intriguing biological advantage has attracted attention and led to research into the movement flexibility mechanism of the honeybee abdomen.



In our study, we revealed the morphological characteristics and the muscle distribution of honeybee abdomen by 3D reconstruction as shown in Fig.1. Considering the similarity of the muscle distribution between two adjacent segments, we obtained the muscle distribution of the muscular driving unit of honeybee abdomen (Fig.2) and we proposed a novel equivalent unit mechanism inspired by it (Fig.3). The extension ratio, bending angle, and swing angle of the equivalent unit mechanism reached 9.36%, 1.22°, and 4.43°, respectively. The deformation ability of the EUM was consistent with the movement of the abdomen

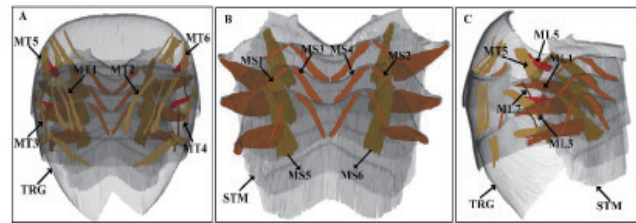


Fig. 1: The morphological characteristics and the muscle distribution of honeybee abdomen by 3D reconstruction. (A)~(C) The muscles distributed on the terga, the sterna and the lateral structures.

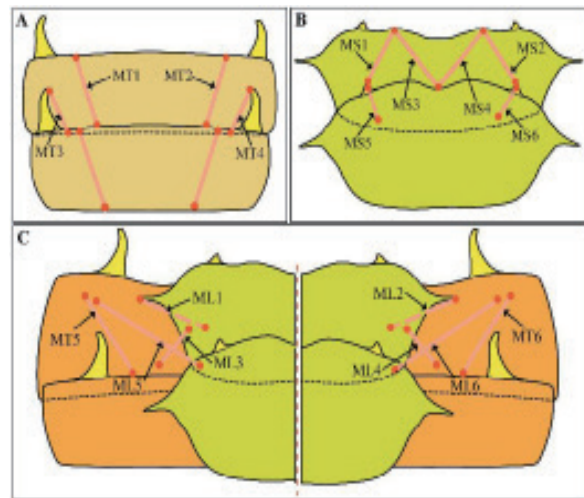


Fig.2: The muscle distribution of the muscular driving unit. (A) The muscle distribution between two adjacent terga; (B) The muscle distribution between two adjacent sterna ; (C) The muscle distribution between the adjacent tergum and sternum.

(Fig.4), confirming the movement flexibility. This work may provide a new perspective for distributed bionic mechanism design.

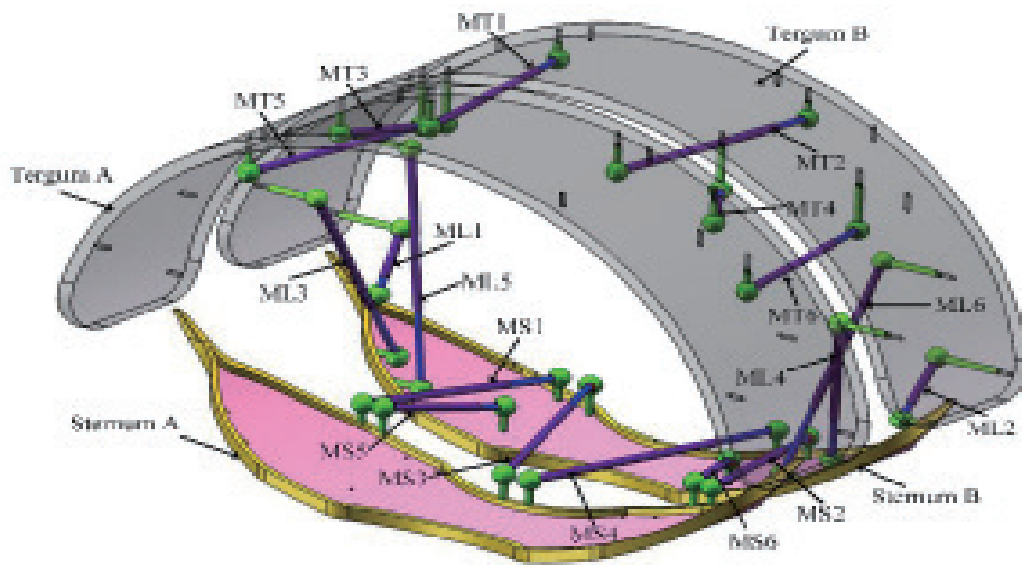


Fig. 3: The equivalent unit mechanism inspired by the muscular driving unit

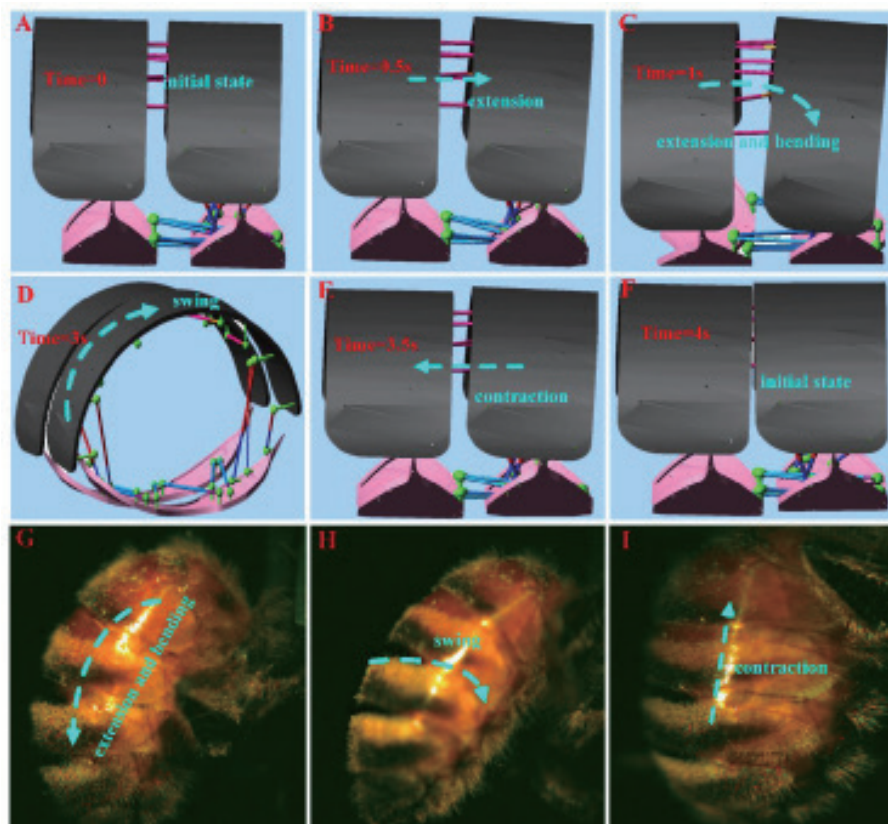


Fig.4: The deformation movement comparison of EUM and honeybee abdomen. (A)~(F) The deformation process of EUM. (G)~(I) The deformation movement of honeybee abdomen.

A Bionic Stratospheric Airship Inspired by *Physalia physalis*

Yueneng Yang, National University of Defense Technology, China

The research work “a bionic stratospheric airship” completed by Associate Professor Yueneng Yang of College of Aerospace Science and Engineering, National University of Defense Technology has been authorized by international invention patent (U.S. patent). In order to solve the key problems of aerodynamic optimization and thermal control of stratospheric airships, an invention is proposed, which provides a bionic stratospheric airship inspired by *Physalia physalis*. Its hull and gasbags are designed via imitation in shape and resemblance in function, respectively. The hull shape is designed by lofting according to the shape of *Physalia physalis*. The gasbags include a helium gasbag, two ballonets and a heat regulating gasbag. The helium gasbag provides static lift, the ballonets are used to ascend and descend by



exhaust and inflation respectively, and the heat adjusting gasbag is filled with a working medium reversibly regulated between a gas state and a liquid state, which is used to adjust the pressure and temperature of the hull in large range. The invention is applied to design a technical test airship, and the experimental results show that it exhibits good flight performance and effective control capability in terms of buoyancy and pressure.



Fig.2 Flight experiments of the bionic airship

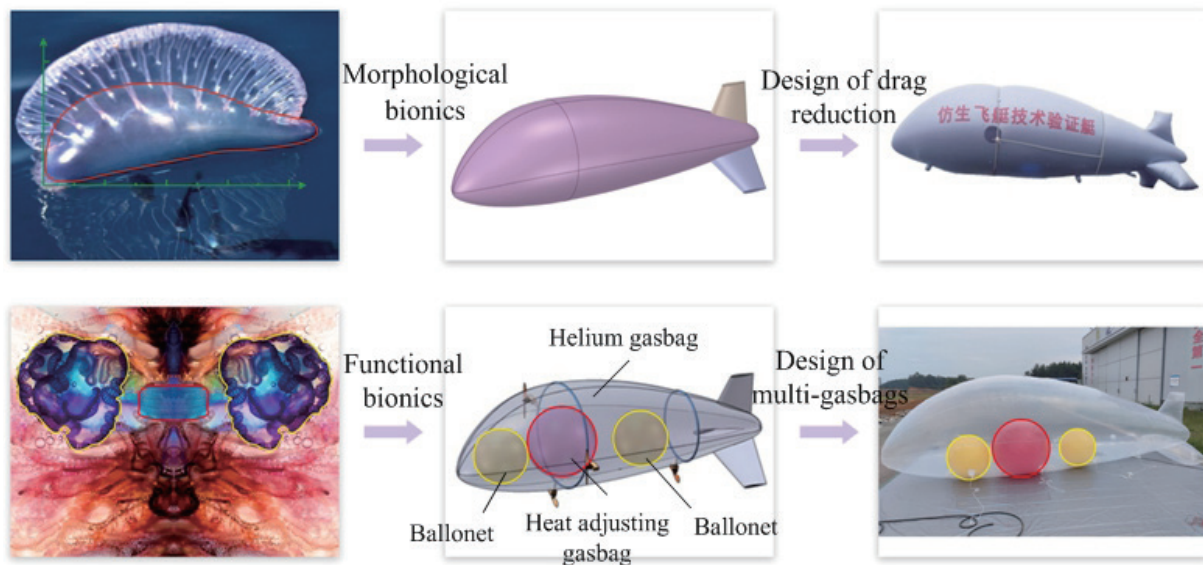


Fig.1 Bionic design process of the airship

The 7th International Conference of Bionic Engineering-ICBE 2022

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Biomimetic science and engineering is a rapidly developing interdisciplinary field that closely relates to biology, chemistry, physics, materials science, mechanical engineering, medicine and other disciplines. The 7th International Conference of Bionic Engineering & the International Youth Conference of Bionic Science and Engineering 2022 (ICBE & IYCBSE 2022) will not only offer a unique platform to exchange information and ideas, and to initiate collaborations between international bionic scholars, but also creates the opportunity to promote the transformation of bionic technologies and to address future challenges for biomimetic science and engineering.

Key Dates

Deadline for abstract and full paper submission: May 30, 2022

Deadline for early-bird registration: July 31, 2022

Conference date: **September 15-18, 2022**

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Fee Type	Early Rate (by July 31, 2022)	Regular Rate
Delegate	2700 RMB / 420 USD	3200 RMB / 500 USD
Student	1700 RMB / 260 USD	2000 RMB / 310 USD
ISBE Individual Member	2300 RMB / 360 USD	2800 RMB / 430 USD
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Participants should register to attend the full conference (offline) and will receive 3 days of conference access including daily refreshments. Registration fees do not include lodging and participants are responsible for securing their hotel accommodations.

Registration page: <http://www.icbe2022.net/EnUserCentral/Index/Login>

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The ICBE & IYCBSE 2022 welcomes original research work and review papers concentrated on conference topics. The abstract or full manuscript should be written in English using the template provided and submitted online in PDF format. Selected peer-reviewed papers will be published in the Journal of Bionic Engineering.

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The theme of ICBE & IYCBSE 2022 is “human, nature, harmony”, including but not limited to the following topics:

- Biological systems & biodiversity
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- Biomaterials and bioinspired materials
- Bionic machinery
- Biomechanics and rehabilitation engineering
- Biosensors and signal processing
- Robotics, motion systems and artificial intelligence
- Nature inspired energy system
- Biofabrication and bioinspired manufacturing
- Sustainable and environmentally friendly novel technologies
- Industrial applications of bionics
- Other fields related with bionics

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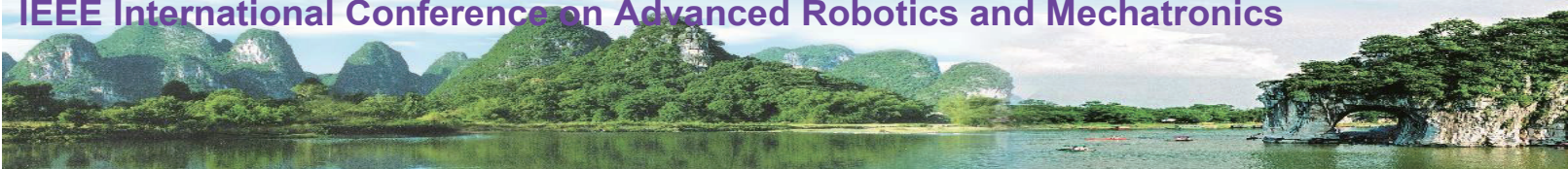
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IEEE International Conference on Advanced Robotics and Mechatronics



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The IEEE International Conference on Advanced Robotics and Mechatronics (ICARM) is the flagship conference of both IEEE-SMC TC on Bio-mechatronics and Bio-robotics Systems, and IEEE-RAS TC on Neuro-Robotics Systems. The ICARM 2022 will take place in the Guilin from July 9th to 11th, 2022. The conference would be organized by Guangxi University, China.

Manuscripts should be submitted to ARM 2022 online at the following link: <http://ras.papercept.net/conferences/scripts/start.pl>.

Conference committees would invite the high-quality papers to be submitted to Robotica online at: <https://mc.manuscriptcentral.com/robotica>, selecting the track 'Robotica/ARM Emerging Topics'. The cover letter must provide the given ARM conference manuscript number and the following statement: This paper is submitted to the ARM conference with the Robotica option on Robotica/ARM Emerging Topics'. **Robotica does not accept the submissions to the Focused Section on Robotica/ARM Emerging Topics unless the conference committees recommend the paper.**

The submitted papers will be subject to a peer review process in the standard of ARM conference and Robotica Journal. All final accepted papers from submissions to the Robotica Journal will be published in the December Issue of Robotica in 2022.

It is, however, possible that a submitted paper to Robotica is rejected but accepted with the ARM conference option. It will be published in the Conference Proceedings and will be included in the IEEE explore. It should be noted that all accepted papers for both choices must be presented in the 2022 IEEE International Conference on ARM (ARM 2022, www.ieee-arm.org).

Topics of Interest:

- Intelligent mechatronics, automation, control systems
- Bionic robotics, autonomous and evolutionary robotics
- Modelling of human sensory and motor systems
- Bionic robot navigation, task and motion planning
- Locomotion and manipulation in biological and robot systems
- Teleoperation, tele-robotics, haptics, and semi-autonomous systems
- Robotic systems modeling, optimization, simulation and experiments
- Control system modeling and simulation techniques and methodologies
- AI, intelligent control, neuro-control, fuzzy control and their applications
- Industrial automation, process control, manufacturing process
- Rehabilitation robot system, neuro-robotics, wearable robots

Important Dates

31 March 2022: Full papers and organized session proposals

31 March 2022: Proposal for tutorials and workshops

30 April 2022: Notification of paper and session acceptance

30 May 2022: Submission of final papers in IEEE PDF format

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