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Yipin SU

Postdoctoral Fellow at USC

Summary

I am a Chinese scholar working in **theoretical mechanics** and **multi-physics**, with applications to the modelling of **soft matter**. I have been trained in some of the best institutions in the field in China, Europe and the US, always putting strong emphasis on geographical and thematic mobility. I have written **21** peer-reviewed articles so far and delivered several talks at national and international events.

After five years of doctoral study at **Zhejiang University (China)**, two years of research in **NUI Galway (Ireland)** and one year of research in **University of Southern California (USA)**, I am fully trained and have acquired a strong and wide background in mechanics and applied mathematics. Specifically, I am an expert in dealing with multidisciplinary problems, and can develop advanced models of static and dynamic behaviours of soft electromagnetic structures. I write advanced numerical code to solve systems of stiff differential equations relying on Runge-Kutta and shooting methods and Hamiltonian integration. I taught myself to use **COMSOL**, **Mathematica** and **Matlab** to write the algorithms of the Surface Impedance Method, Space State Method and Compound Matrix Method.

Thanks to years of study and research, I have become a **mature and independent scholar**, and am interested in an academic career to continue my research. In fact, I am eagerly seeking the opportunity to apply my experience and training in nonlinear theory of electro-elasticity (and magneto-elasticity as well) to new and exciting fields, such as periodic structures, biomechanics, and metamaterials.

My **long-term goal** is to reach an expert level in theoretical, computational and experimental mechanics of soft materials, including electro- and magneto-active materials, polymeric gels and soft tissues, for a research-based career in academia.

Education, Employment and Research Highlights

2019-current **Postdoctoral Fellow**, *Bioinspired Manufacturing and Mechanics*, USC, USA.
Supervisor: **Qiming Wang**
Topic: *Mechanics of living lattice composites with growing crystals*

2019 Jul-Aug **Visiting Researcher**, *Applied Mathematics*, Politecnico di Bari, Italy.
Supervisor: **Professor Giuseppe Puglisi** & **Professor Giuseppe Devillanova**
Topic: *Voltage-induced blisters in a circular tube*

2019 May-Jul **Visiting Postdoc**, *Applied Mathematics*, Politecnico di Milano, Italy.
Supervisor: **Professor Pasquale Ciarletta**
Topic: *Bulging instability of a substrate-film structure due to inhomogeneous growth; Isogeometric Analysis*

2018 Jul-Sep **Visiting Postdoc**, *Engineering Mechanics*, Technion, Israel.
Supervisor: **Professor Gal Shmuel**
Topic: *Topology optimization of dielectric elastomer for wide band gaps*

2017-2019 **Irish Research Council Postdoctoral Fellow**, *Solid Mechanics*, NUI Galway, Ireland.
Supervisor: **Professor Michel Destrade**
Topic: *Instabilities in advanced materials and structures*

2015-2016 **Joint Training PhD**, *Theoretical Mechanics and Multi-physics*, NUI Galway, Ireland.
Supervisor: **Professor Michel Destrade**
Topic: *Application of the surface impedance method to problems of soft electroactive materials*

2011-2016 **PhD**, *Solid Mechanics*, Zhejiang University, China.
Supervisors: **Professor Weiqiu Chen** & **Professor Michel Destrade**
Thesis: *Analysis of waves and instabilities in soft electroactive structures under biasing fields*

2007-2011 **BSc (Hons)**, *Engineering Mechanics*, Wuhan University, China.
Supervisor: **Professor Wenyang Yuan**
Thesis: *Mechanical analysis of buried pressure pipeline*

Commissions of trust

2019 **Invited contribution** to Special Issue of ***International Journal of Non-Linear Mechanics*** on "Instability and Bifurcation in Materials and Structures" (see publication **[20]**).

2019 **Guest Editor** (with Weiqiu Chen and Michel Destrade) of Special Issue of ***International Journal of Non-Linear Mechanics*** on "Nonlinear theory of electro- and magneto-elasticity" (see publication **[18]**).

2019 **Invited contribution** to Special Issue of ***Journal of Mechanics and Physics of Solids*** in honor of Davide Bigoni's 60^{th} birthday (see publication **[13]**).

2019 **Invited contribution** to Special Issue of ***International Journal of Non-Linear Mechanics*** on "Mathematics & Mechanics: Natural Philosophy in the 21^{st} Century" (see publication **[12]**).

2017-present **Reviews for Scientific Journals**: Proceedings of the Royal Society A; Applied Mathematics and Mechanics (English Edition); Mechanics of Advanced Materials and Structures; Philosophical Transactions of the Royal Society A; International Journal of Solids and Structures.

Research Interests

- **Analysis of Instabilities in Solids** (pull-in, buckling, wrinkling, post-buckling);
- **Mechanics of Advanced Materials and Structures** (piezoelectrics, soft electro- and magneto-elastomers);
- **Wave Propagation & Free Vibration Analysis** (tunable waveguides, phononic crystals & metamaterials);
- **Biomechanics** (growth theory, crystal growth).

Scientific Skills

- **Theoretical Expertise**: Nonlinear Electro-elasticity Theory, Small-on-Large Theory, State Space Method, Surface Impedance Matrix Method, Arc-Length Method, Muller (Parabolic) Searching Method for complex roots, Transfer Matrix Method and Plane Wave Expansion Method for calculating band structures, precipitation-induced crystal growth;
- **Numerical and Software Competency**: COMSOL, Mathematica, Matlab, Abaqus, FEM, Isogeometric Analysis, LaTeX, Endnote, Mathtype.

Funded Research Projects

[F1] *Interfacial Self-healing of Nanocomposite Hydrogels*,
Postdoctoral Fellowship of USC ($110,000) 2019-2022,
[**Role**: Postdoctoral researcher]

[F2] *Buckling-induced blisters in a circular dielectric tube*,
Associazione di Fondazioni e di Casse di Risparmio S.p.a. (ACRI) within the Young Investigator Training Program 2019 (€3,000),
[**Role**: Visiting researcher]

[F3] *Polymeric gels: modelling, simulations and experiments*,
Government of Ireland Postdoctoral Fellowship (€92,000) 2017-2019,
[**Role**: Principal Investigator]

[F4] *Performance optimization and manipulation of elastic waves in periodic soft materials and structures*,
National Natural Science Foundation of China (€562,500) 2016-2020,
[**Role**: Participated]

[F5] *Linear and nonlinear waves in soft electro-elastic solids and structures*,
National Natural Science Foundation of China (€110,000) 02013-2016,
[**Role**: Participated]

[F6] *Dynamic characteristics and control mechanisms of layered electro-magnetic composite materials and structures*,
National Natural Science Foundation of China (€250,000) 2011-2014.
[**Role**: Participated]

Selected Honors and Awards

2017-2019 Government of Ireland Postdoctoral Fellowship, *Irish Research Council*

2019 Jul-Aug One-month Research Fellow, *Associazione di Fondazioni e di Casse di Risparmio S.p.a. (ACRI) within the Young Investigator Training Program 2019, Politecnico di Bari*

2015-2016 Visiting student scholarship for International Collaborative Research, *Zhejiang University*

2015 Annual Outstanding PhD student, *Zhejiang University*

2014 Annual Outstanding PhD student, *Zhejiang University*

2011-2016 PhD grant, *Ministry of Education of the People's Republic of China*

Publications Under review

2020 [4] **YP Su**, M Destrade, RW Ogden.
Bending control and instability of functionally graded dielectric elastomers.

[3] Z Gao, K Yu, **YP Su**, Q Wang.
Mechanics of Nanoadhesives.

[2] **YP Su**, A Xin, Q Wang.
Mechanics of Living Lattice Composites with Growing Crystals.

[1] A Xin, **YP Su**, S Feng, M Yan, K Yu, Z Feng, L Sun, Q Wang.
Bacteria-assisted manufacturing of mineralized structural composites with exceptional mechanical properties.

Publications (*Corresponding author)

2020 [21] **YP Su***,
Voltage-controlled instability transitions and competitions in a finitely deformed dielectric elastomer tube.
***International Journal of Engineering Science**, 157, 103380*.
[Impact Factor 2019 = 9.219; Rank: 1/91 journals in "Engineering & Multidisciplinary"; Quartile: **Q1**].

[20] W Zhou, Y Chen, **YP Su***.
Bifurcation of a finitely deformed functionally graded dielectric elastomeric tube.
***International Journal of Non-Linear Mechanics**, 103593*.
[invited contribution to Special Issue of International Journal of Non-Linear Mechanics on Instability and Bifurcation in Materials and Structures]
[Impact Factor 2019 = 2.313; Rank: 59/136 journals in "Mechanics"; Quartile: **Q2**].

[19] **YP Su***, WQ Chen, L Dorfmann, M Destrade.
The effect of an exterior electric field on the instability of dielectric plates.
Proceedings of the Royal Society A 476 (2239) (2020) 20200267. **[Link]**
[Impact Factor 2019 = 2.714; Rank: 14/368 journals in "Engineering-General Mathematics"; Quartile: **Q1**].

[18] **YP Su**, M Destrade, WQ Chen.
Preface to the special issue of the International Journal of Non-Linear Mechanics on Nonlinear theory of electro-and magneto-elasticity.
International Journal of Non-Linear Mechanics 103568 (2020). **[Link]**
[Impact Factor 2019 = 2.313; Rank: 59/136 journals in "Mechanics"; Quartile: **Q2**].

[17] YK Du, **YP Su**, CF Lü, WQ Chen, M Destrade.
Electro-Mechanically Guided Growth and Patterns.
Journal of the Mechanics and Physics of Solids 104073 (2020). **[Link]**
[Impact Factor 2019 = 5; Rank: 9/136 journals in "Mechanics"; Quartile: **Q1**].

[16] WJ Zhou, **YP Su**, WQ Chen, CW Lim.
Voltage-controlled quantum valley Hall effect in dielectric membrane-type acoustic metamaterials.
International Journal of Mechanical Sciences 172 (2020) 105368. **[Link]**
[Impact Factor 2019 = 4.631; Rank: 14/136 journals in "Mechanics"; Quartile: **Q1**].

[15] CJ Wang, S Zhang, S Nie, **YP Su**, WQ Chen, JZ Song.
Buckling of a stiff thin film on a bi-layer compliant substrate of finite thickness.
International Journal of Solids and Structures 188 (2020) 133-140. **[Link]**
[Impact Factor 2019 = 3.213; Rank: 30/136 journals in "Mechanics";
Quartile: **Q1**].

[14] YJ Chen, B Wu, **YP Su**, WQ Chen.
Effects of strain stiffening and electrostriction on tunable elastic waves in compressible dielectric elastomer laminates.
International Journal of Mechanical Sciences 105572 (2020). **[Link]**
[Impact Factor 2019 = 4.631; Rank: 14/136 journals in "Mechanics";
Quartile: **Q1**].

[13] **YP Su**, B Wu, WQ Chen, M Destrade.
Pattern evolution in bending dielectric-elastomeric bilayers.
Journal of the Mechanics and Physics of Solids 136 (2020) 103670.
[invited contribution to Special Issue in Honour of Davide Bigoni] **[Link]**
[Impact Factor 2019 = 5; Rank: 9/136 journals in "Mechanics";
Quartile: **Q1**].

2019 [12] **YP Su**, WQ Chen M Destrade.
Tuning the pull-in instability of soft dielectric elastomers through loading protocols.
International Journal of Non-Linear Mechanics 113 (2019) 62-66.
[invited contribution to Special Issue on Natural Philosophy in the 21st Century] **[Link]**
[Impact Factor 2019 = 2.313; Rank: 59/136 journals in "Mechanics";
Quartile: **Q2**].

[11] YJ Chen, B Wu, **YP Su**, WQ Chen.
Tunable two-way unidirectional acoustic diodes: design and simulation.
Journal of Applied Mechanics 86 (2019) 031010. **[Link]**
[Impact Factor 2019 = 2.671; Rank: 44/136 journals in "Mechanics";
Quartile: **Q2**]

[10] **YP Su**, B Wu, WQ Chen, M Destrade.
Finite bending and pattern evolution of the associated instability for a dielectric elastomer slab.
International Journal of Solids and Structures 158 (2019) 191-209. **[Link]**
[Impact Factor 2019 = 3.213; Rank: 30/136 journals in "Mechanics";
Quartile: **Q1**].

[9] WJ Zhou, B Wu, **YP Su**, DY Liu, WQ Chen, RH Bao.
Tunable flexural wave band gaps in a prestressed elastic beam with periodic smart resonators.
Mechanics of Advanced Materials and Structures (2019) 1-8. **[Link]**
[Impact Factor 2019 = 3.517; Rank: 22/136 journals in "Mechanics";
Quartile: **Q1**].

2018 [8] **YP Su**, HC Broderick, WQ Chen, M Destrade.
Wrinkles in soft dielectric plates.
Journal of the Mechanics and Physics of Solids 119 (2018) 298-318. **[Link]**
[Impact Factor 2019 = 5; Rank: 9/136 journals in "Mechanics";
Quartile: **Q1**].

[7] B Wu, **YP Su**, D Liu, WQ Chen, CZ Zhang
On propagation of axisymmetric waves in pressurized functionally graded elastomeric hollow cylinders.
Journal of Sound and Vibrations 421 (2018) 17-47. **[Link]**
[Impact Factor 2019 = 3.429; Rank: 26/136 journals in "Mechanics";
Quartile: **Q1**].

[6] **YP Su**, B Wu, WQ Chen, CF Lü.
Optimizing parameters to achieve giant deformation of an incompressible dielectric elastomeric plate.
Extreme Mechanics Letters 22 (2018) 60-68. **[Link]**
[Impact Factor 2019 = 4.806; Rank: 12/136 journals in "Mechanics";
Quartile: **Q1**].

2017 [5] WJ Zhou, WQ Chen, XD Shen, **YP Su**, EN Pan.
On surface waves in a finitely deformed coated half-space.
International Journal of Solids and Structures 128 (2017) 50-66. **[Link]**
[Impact Factor 2019 = 3.213; Rank: 30/136 journals in "Mechanics";
Quartile: **Q1**].

[4] B Wu, **YP Su**, WQ Chen, CZ Zhang
On guided circumferential waves in soft electroactive tubes under radially inhomogeneous biasing fields.
Journal of the Mechanics and Physics of Solids 99 (2017) 116-145. **[Link]**
[Impact Factor 2019 = 4.806; Rank: 12/136 journals in "Mechanics";
Quartile: **Q1**].

2016 [3] **YP Su**, HM Wang, CL Zhang, WQ Chen.
Propagation of non-axisymmetric waves in a soft electroactive hollow cylinder under uniform biasing fields.
International Journal of Solids and Structures 81 (2016) 262-273. **[Link]**
[Impact Factor 2019 = 4.806; Rank: 12/136 journals in "Mechanics";
Quartile: **Q1**].

[2] **YP Su**, WJ Zhou, WQ Chen, CF Lü.
On buckling of a soft incompressible electroactive hollow cylinder.
International Journal of Solids and Structures 97 (2017) 400-416. **[Link]**
[Impact Factor 2019 = 4.806; Rank: 12/136 journals in "Mechanics";
Quartile: **Q1**].

2015 [1] **YP Su**, WQ Chen.
Axisymmetric waves in incompressible soft electroactive cylindrical shells subject to a biasing field.
Chinese Journal of Applied Mechanics 31 (2014) 7-13. **[Link]**

Conferences

2020 **Oral presentation**: Pattern evolution in bending dielectric-elastomeric bilayers. *1st Southern California Mechanics Workshop.* Jan 18, 2020. San Diego, California, US.

2019 **Oral presentation**: Instabilities in soft dielectrics. *Two Nonlinear Days 2019.* Jul 11-12, 2019. Urbino, Italy.

Oral presentation: Pattern evolution in bending dielectric-elastomeric bilayers. *International Workshop on Multiscale spectrum.* Jul 01-05, 2019. Castro, Spain.

2018 **Oral presentation**: Wrinkles in soft dielectric plates. *ECCM-ECFD: The joint 6th European Conference on Computational Methods (Solids, Structures and Coupled Problems) and the 7th European Conference on Computational Fluid Dynamics.* Jul 11-15, 2018. Glasgow, UK.

Oral presentation: Voltage-induced self-bending and the associated instability of an elastomer-dielectric bilayer. *Elasticity Day 2018.* May 12, 2018. Manchester, UK.

2017 **Oral presentation**: Waves in functionally graded dielectric tubes. *ICCS20: the 20th International Conference on Composite Structures.* Sep 03-07, 2017. Paris, France.

Oral presentation: Viscoelastic deformation and the associated snap- through instability of an incompressible dielectric plate. *CCTAM 2017: Chinese Congress of Theoretical and Applied Mechanics.* Aug 14-16, 2017. Beijing, China.

2015 **Oral presentation**: Propagation of non-axisymmetric waves in a soft electroactive hollow cylinder under uniform biasing fields. *Symposium: Advances in Mechanics.* Dec 03-04, 2015. Dublin, Ireland.

Oral presentation: Propagation of non-axisymmetric waves in an infinite soft electroactive hollow cylinder under inhomogeneous biasing fields - the State Space Formulism. *CCTAM 2015: Chinese Congress of Theoretical and Applied Mechanics.* Aug 15-18, 2015. Shanghai, China.

2012 **Oral presentation**: Waves in Soft Electroactive Cylindrical Shells Subject Nanjing, to Elastic and Electric Biasing Fields. *ICAST 2012: 23rd International Conference on Adaptive Structures Technologies.* Oct 10-13, 2012. Nanjing, China.

Invited presentation

2018 **Oral presentation**: Buckling instabilities in dielectrics structures. **Invited by Professor Tongqing Lu.** Jul 28-29, 2018. Xi'an jiaotong Uiversity, Xi'an, China.

References

- **Professor Weiqiu Chen (chenwq@zju.edu.cn) [Website]**
  Head of Mechanics of Smart Materials and Structures Group, Zhejiang University.
- **Professor Michel Destrade (michel.destrade@nuigalway.ie) [Website]**
  Chair of Applied Mathematics, NUI Galway, Ireland.
- **Professor Ray Ogden (Raymond.Ogden@glasgow.ac.uk) [Website]**
  George Sinclair Professor of Mathematics, University of Glasgow, UK.