

**Shaoyun Wang**+1 (573)-489-9584, [shaoyunwang@mail.missouri.edu](mailto:shaoyunwang@mail.missouri.edu)<https://wangshaoyun.github.io>Ph.D. Student, Dept. of Mechanical & Aerospace Engineering  
University of Missouri – Columbia, MO, 65211**EDUCATION**

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| <b>University of Missouri – Columbia</b>                        | Columbia, MO, US |
| Ph.D. student, Mechanical Engineering                           | 2020-Now         |
| Advisor: Guoliang Huang   |                  |
| <b>Ningbo University</b>  | Ningbo, China    |
| MS, Theoretical Physics   | 2016-2019        |
| Advisor: Chaohui Tong, Molecular simulation of polyelectrolytes |                  |
| Advisor: Ji Wang, Dynamical theory of plates                    |                  |
| GRE Scores: 165Q, 150V, 3W                                      |                  |
| TOEFL Scores: 88 total, 28R, 22L, 18S, 20W                      |                  |
| <b>Ningbo University</b>  | Ningbo, China    |
| BE, Engineering Mechanics, GPA: 3.29/4                          | 2012-2016        |

**HONORS AND AWARDS**

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| <b>Second-class Scholarship</b>   | 2018, 2013 |
| Ningbo University   |            |
| <b>Student best paper finalists</b>   |            |
| Second Academic Forum for Postgraduate of Mechanics between Ningbo University and Zhejiang University | 2018       |
| <b>First-class Scholarship</b>  | 2016       |
| Ningbo University   |            |
| <b>Student best paper finalists</b>   |            |
| 12 <sup>th</sup> Symposium on Piezoelectricity Acoustical Theory and Device Application conference    | 2016       |

**RESEARCH EXPERIENCE**

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**Monte Carlo simulation of weak polyelectrolyte (Still ongoing)**

- Developed constant pH Monte Carlo with computational complexity  $\mathcal{O}(N \log(N))$  to simulate ionization equilibrium of weak polyelectrolyte.
- Used bond fluctuation model and configurational biased Monte Carlo to accelerate equilibrium of polyelectrolytes.
- Combined Multistep algorithm with smooth particle mesh Ewald method to calculate long-range potential.
- The codes are more than 4000 lines and open sourced in GitHub: [https://github.com/wangshaoyun/Bond\\_Fluctuation\\_Method\\_SPME](https://github.com/wangshaoyun/Bond_Fluctuation_Method_SPME)

### Molecular Dynamics simulation of polyelectrolytes brushes

- Used Langevin dynamics to simulate different polyelectrolyte brushes by home-made program.
- The program which equipped with most efficient algorithm for short-range and long-range potential is same efficient as Lammmps and Gromacs.
- Studied morphology and charge overcompensation of star brushes, two layer structure of mixing linear and star brushes, condition of charge overcompensation of star brushes, and competition and bridging of brushes with trivalent salts.
- Analytical self-consistent field theory were also used to compare the numerical results.
- The codes are more than 5000 lines and open sourced in GitHub: [https://github.com/wangshaoyun/MD\\_Brushes](https://github.com/wangshaoyun/MD_Brushes)

### Searching novel cuts of quartz resonators

- Established frequency temperature of infinite plates by incremental thermo field theory in continuum mechanics.
- Used global optimization by solving nonlinear equations strictly to search the cutting angles with best temperature stability.
- Explained all existed commercial cuts parameters and predicted more cuts with better temperature stability.
- Prof. Y. K. Yong in Rutgers university spoken highly of this work and a company is developing these new products.

### Other theoretical research in solid mechanics

- Solved Mathieu equation of circular plate vibration.
- Solved Rayleigh wave equation in polar coordinate.
- Studied high-order deformation of plates by using power series expansion.
- Measure elastic constants by solving the inverse problem of vibration.

### PATENTS

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**S. Y. Wang**, J. Wang, L. M. Zhang, L. T. Xie, T. F. Ma, J. K. Du, M. C. Chao. A Novel Quartz Cut for Thermometer Resonator. Chinese Patent, submitted.

**S. Y. Wang**, J. Wang, L. M. Zhang, L. T. Xie. Novel Quartz Resonator Cuts with Stable Frequency-Temperature Property. Chinese Patent, to be submitted.

### PUBLICATIONS

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1. Longtao Xie, **Shaoyun Wang**, Junlei Ding, J Ranjan Banerjee, Ji Wang (2020), [An accurate beam theory and its first-order approximation in free vibration analysis](#), *Journal of Sound and Vibration*, 485, 115567.
2. **S. Y. Wang**, C. H. Tong. Cell-lists Method for Monte Carlo Simulation (2020), [arXiv:2003.05581](https://arxiv.org/abs/2003.05581).
3. Y. Ji, **S. Y. Wang**, C. H. Tong (2020). The Collapse of Polyelectrolyte Brushes Made of 4-arm Stars Mediated by Trivalent Salt Ions and an Electric Field, *Journal of Chinese Chemical Physics*, accepted.

4. T. B. Wang, **S. Y. Wang**, C. H. Tong (2020). [Charge Reversal of Polyelectrolyte Brushes Under a Collapsing Electric Field](#), *Chemical Physics*, 536, 110810.
5. Ji Wang, **Shaoyun Wang**, Longtao Xie, Yangyang Zhang, Lili Yuan, Jianke Du, Han Zhang (2020). [The Axisymmetric Rayleigh Waves in a Semi-infinite Elastic Solid](#), *Theoretical & Applied Mechanics Letters*, 10, 120-124.
6. **S. Y. Wang**, C. H. Tong (2020). [Surface Switching of Mixed Polyelectrolyte Brushes Made of 4-arm Stars and Linear Chains: MD Simulations](#), *Journal of Applied Physics*, 127 (7) 074301, Editor's pick.
7. F. Zhang, **S. Y. Wang**, H. T. Ding, C. H. Tong (2019). [Simulations of 3-Arm Polyelectrolyte Star Brushes under External Electric Fields](#), *Soft Matter*, 15, 2560-2570. (Back cover).
8. **S. Y. Wang**, L. T. Xie, L. M. Zhang, R. X. Wu, J. K. Du, J. Wang (2019). [Novel Cuts of Triply-Rotated Quartz Crystal for Resonators With Ideal Cubic Frequency-Temperature Relations](#). *Proceedings of the 2019 Symposium on Piezoelectricity, Acoustic Waves and Device Applications*, Paper number: 18584340.
9. Xie. L. T., **S. Y. Wang**, C. Z. Zhang, J. Wang (2018). [An Analysis of the Thickness Vibration of an Unelectroded Doubly-rotated Quartz Circular Plate](#). *Journal of Acoustical Society of America*, 144 (2), pp. 814-821
10. **S. Y. Wang**, L. M. Zhang, L. T. Xie, B. Huang, A. B. Zhang, J. K. Du, R. X. Wu, J. Wang, Y. K. Yong (2018). [Novel Quartz Crystal Cuts for SAW Substrates with Cubic Frequency-temperature Relations](#), *2018 IEEE International Ultrasonics Symposium*, Paper number: 18348332.
11. Zhang, L. M., **Wang S. Y.**, L. T. Xie, T. F. Ma, J. K. Du, J. Wang (2018). [Frequency-temperature Relations of Novel Cuts of Quartz Crystals for Resonator Applications](#), *2018 IEEE International Frequency Control Symposium*, Paper number: 18384201.
12. J. Wang, L. M. Zhang., **S. Y. Wang.**, L. T. Xie, B. Huang, T. F. Ma, J. K. Du, M. C. Chao, J. L. Shen, R. X. Wu, H. F. Zhang (2017). [Optimal Orientations of Quartz Crystals for Bulk Acoustic Wave Resonators with the Consideration of Thermal Properties](#), *2017 Proceedings of Meetings on Acoustics*, 32 (1).
13. **S. Y. Wang**, R. X. Wu, S. Y. Pao, L. M. Zhang, T. F. Ma, J. K. Du, J. Wang (2016). [The Frequency Equation of Thickness-shear Vibrations of SC-cut Quartz Crystal Plates](#), *Proceedings of the 2016 Symposium on Piezoelectricity, Acoustic Waves and Device Applications*, pp. 230-234.
14. **S. Y. Wang**, B. Neubig, J. H. Wu, T. F. Ma, J. K. Du, J. Wang (2016). [Extension of the Frequency Aging Model of Crystal Resonators and Oscillators by the Arrhenius Factor](#), *Proceedings of the 2016 Symposium on Piezoelectricity, Acoustic Waves and Device Applications*, pp. 269-272.
15. **S. Y. Wang**, B. Neubig, K. Sato, T. Hosoda, E. Seydel, J. H. Wu, T. F. Ma, J. Wang (2016). [Aging Models and Parameters of Quartz Crystal Resonators and Oscillators](#), *Proceedings of the 2015 Symposium on Piezoelectricity, Acoustic Waves and Device Applications*, pp. 382-385.

**SELECTED PRESENTATIONS:**

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**S. Y. Wang**, J Wang, et al. Novel cuts of triply-rotated quartz crystal for resonators with ideal cubic frequency-temperature relations. Oral presentation delivered at Proceedings of the 2019 Symposium on Piezoelectricity, Acoustic Waves and Device Applications, Harbin, China, Jan. 14-17, 2019.

**S. Y. Wang**, L. M. Zhang et al. Novel quartz crystal cuts for saw substrates with cubic frequency-temperature relations. Poster presentation delivered at IEEE International Ultrasonics Symposium, Chiba, Japan, Oct. 18-22, 2018.

J. Wang, **S. Y. Wang** et al. Novel cuts of triply-rotated quartz crystal for resonators with ideal cubic frequency-temperature relations. Plenary talk at 5th World Congress and Expo on Oil, Gas, and Petroleum Engineering, Rosa Grand Hotel, Milan, Italy, March 28-29, 2019.

J. Wang, **S. Y. Wang** et al. Optimal orientations of quartz crystals for bulk acoustic wave resonators with superior frequency-temperature properties. Plenary talk at ICNNE, June 21-25, Milan, Italy, 2018.

L. M. Zhang, **S. Y. Wang** et al. Frequency-temperature relations of novel cuts of quartz crystals for resonator applications. Poster presentation delivered at IEEE International Frequency Control Symposium, Olympic Valley, CA, USA, May 21-14, 2018.

**SKILLS**

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**Programming:**

- I have finished more than 10000 lines Matlab and 50000 lines Fortran codes.
- I am familiar with Latex/Tex in writing notes and Mathematica in derivation of formulas.
- I can use Java, HTML and Markdown to design website.
- Although not frequently used, I also know C/C++, Python and other languages.

**Molecular Dynamics and FEM Analysis:** Lammmps, COMSOL, ANSYS, ABAQUS

**Scientific Drawing:** Photoshop, Illustrator, Cinema 4D

**Design:** Personal website, group website, conference flyer, poster, animation, book and video.