Bo Ni

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EDUCATION

Ph.D. in *Solid Mechanics* Brown University *2020*
Thesis: *Mechanics of fracture and toughening in 2D materials* Advisor: Huajian Gao

M.Sc. in *Solid Mechanics* Xi'an Jiaotong University (XJTU) *2013*
Thesis: *Analytical study of surface-related dislocation nucleation under Hertzian contact in 2D*
Advisor: Lifeng Ma

B.Sc. in *Engineering Mechanics* XJTU *2011*

RESEARCH INTERESTS & EXPERIENCES

Research assistant (Advisor: *Prof. Huajian Gao*), Brown University Providence, RI

- Fracture and toughening of 2D materials

- Study nonlinear coupling between ***topological defects***, ***curvature*** and ***crack*** in 2D materials
- Propose a ***mechanism-guided*** design library for ***topological toughening*** of 2D materials
- Unveil the interaction between ***asymmetric edge stress*** and crack in *h*-BN theoretically
- Study the effect of ***interlayer friction*** on intralayer fracture in multilayered 2D materials

- Metamaterial design of 3D nanolattices

- Implement ***snap-through*** instability in ***3D graphene*** nanolattice through numerical simulation
- Propose theoretical model for rational design of ***pseudo plasticity*** in 3D graphene

- Advanced simulation of thin shell fracture

- Implement ***phase field*** fracture model for thin shell structures using ***isogeometric analysis***
- Include the effects of large deformation, ***anisotropic fracture energy*** and ***surface effect***

- Fracture mechanics in lithium batteries

- Theoretically study the effect of ***applied T-stress*** on ***crack-inclusion interaction***

- Deep learning approach to inverse problems in mechanics

- Leverage ***deep learning*** models to solve ***inverse problems*** in ***non-destructive evaluations***

PUBLICATIONS

Published

7. Kai Guo*, **Bo Ni***, Huajian Gao (2020). Tuning crack-inclusion interaction with an applied T-stress. *International Journal of Fracture, 1-11* (*Co-first authors).
6. **Bo Ni**, Huajian Gao (2020). Harness the Power of Fracture: Controlled Fragmentation of Graphene via Substrate Necking. *Matter,* 2(3), 521-524.
5. **Bo Ni**, Huajian Gao (2020). Engineer Energy Dissipation in 3D Graphene Nanolattice Via Reversible Snap-Through Instability. *Journal of Applied Mechanics*, 87(3).
4. **Bo Ni**, Xing Liu, Zhigong Song, Huajian Gao (2020). A Century of Fracture Mechanics: from Griffith Theory to Machine Learning Based Modelling. *2020 Adhesion Society Annual Meeting,* (for the plenary talk delivered by Prof. Huajian Gao).
3. **Bo Ni***, Teng Zhang*, Jiaoyan Li, Xiaoyan Li, Huajian Gao (2019). Topological design of graphene. *Handbook of Graphene, Volume 2: Physics, Chemistry, and Biology*, Chapter 1 (*Co-first authors).
2. Jiaoyan Li, **Bo Ni**, Teng Zhang, Huajian Gao (2018). Phase field crystal modeling of grain boundary structures and growth in polycrystalline graphene. *Journal of the Mechanics and Physics of Solids*, 120, 36-48.
1. Emily Hacopian*, Yingchao Yang*, **Bo Ni***, Yilun Li, Xing Li, Qing Chen, Hua Guo, James Tour, Huajian Gao, Jun Lou (2018). Toughening Graphene by Integrating Carbon Nanotubes. *ACS nano*, 12(8), 7901-7910 (*Co-first authors).

Under review

8. **Bo Ni** , Huajian Gao (2020). A deep learning approach to the inverse problem of modulus identification in elasticity. *under review.*
9. Guoxin Cao, Yunpeng Renb, **Bo Ni**, Tao Wang, Zhuo Zhuang (2020). Indentation response of freestanding two-dimensional materials with an adhesive boundary condition. *under review.*
10. Yingchao Yang, Zhigong Song, Guangyuan Lu, Qinghua Zhang, **Bo Ni**, Chao Wang, Xiaoyan Li, Lin Gu, Xiaoming Xie, Huajian Gao, Jun Lou (2020). Lattice Asymmetry Induced Intrinsic Toughening and Stable Crack Propagation in Monolayer *h*-BN. *under review.*

In preparation

- **Bo Ni** , Jiaoyan Li, Teng Zhang, Huajian Gao (2020). Topological toughening of graphene, *in preparation*.
- **Bo Ni**, Huajian Gao (2020). Crack propagation in multilayered 2D materials in the presence of interlayer sliding, *in preparation*.
- **Bo Ni**, Zhigong Song, Huajian Gao (2020). Phase field modeling of crack propagation under asymmetric surface stress, i*n preparation*.

PRESENTATIONS

Topics on *topological toughening of 2D materials*

Aspen center for physics 2020 winter conference: low-dimensional solids in hard and soft condensed matter: mechanics, thermodynamics and electrons, Aspen, CO	Feb 2020
56th Annual Technical Meeting of the Society of Engineering Science (***SES***), St. Louis, MO	Oct 2019
18th National Congress for Theoretical and Applied Mechanics (***USNC-TAM***), Chicago, IL	Jun 2018
AVS 64th International Symposium & Exhibition, Tampa, FL	Nov 2017
53th Annual Technical Meeting of the Society of Engineering Science (***SES***), Maryland, MD	Oct 2016

Topics on *tuning crack-inclusion interaction via applied T-stress*

56th Annual Technical Meeting of the Society of Engineering Science (***SES***), St. Louis, MO	Oct 2019
Engineering mechanics institute conference (***EMI***) 2019, Pasadena, CA	Jun 2019

Topics on *3D architected graphene nanolattices*

54th Annual Technical Meeting of the Society of Engineering Science (***SES***), Boston, MA	Jul 2017

TEACHING

Teaching assistant, Brown University		Providence, RI
-ENGN 1750: *Advanced Mechanics of Solids*	Prof. Allan Bower	Fall 2018
-ENGN 1300: *Structural Analysis*	Prof. Huajian Gao	Spring 2018
-ENGN 2410: *Thermodynamics of Materials*	Prof. David Paine	Fall 2017

REVIEWERSHIP/SERVICES

- Serve as a **reviewer** for *Physics Review Letter (PRL)*, *Journal of the Mechanics and Physics of Solids (JMPS)*, *Physics Review B (PRB), Modelling and Simulation in Materials Science and Engineering (MSMSE) and Journal of Materials Research (JMR)*.
- Assisted the advisor with **grant writing** for the application of National Science Foundation (NSF) Award #1634492, titled *topological design of tough multi-functional 2D materials*.

HONORS AND AWARDS

-Travel award, Aspen center for physics 2020 winter conference	Feb 2020
-Student travel award, 2D materials Focus topic, AVS-64 international symposium	Nov 2017
-The Scholarship in the name of *Tang Zhaoqian,* XJTU, China	2011
-National Scholarship for Encouragement, XJTU, China	2010
-National Scholarship, XJTU, China	2009
-National Scholarship, XJTU, China	2008
-The First Prize, Competition of Fundamental Mechanics, Shaanxi Province, China	2008

- Study nonlinear coupling between ***topological defects***, ***curvature*** and ***crack*** in 2D materials
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- Include the effects of large deformation, ***anisotropic fracture energy*** and ***surface effect***

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- Leverage ***deep learning*** models to solve ***inverse problems*** in ***non-destructive evaluations***

Aspen center for physics 2020 winter conference: low-dimensional solids in hard and soft condensed matter: mechanics, thermodynamics and electrons, Aspen, CO	Feb 2020
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18th National Congress for Theoretical and Applied Mechanics (***USNC-TAM***), Chicago, IL	Jun 2018
AVS 64th International Symposium & Exhibition, Tampa, FL	Nov 2017
53th Annual Technical Meeting of the Society of Engineering Science (***SES***), Maryland, MD	Oct 2016

Teaching assistant, Brown University		Providence, RI
-ENGN 2410: Thermodynamics of materials	Prof. David Paine	Fall 2017
-ENGN 1300: Structural Analysis	Prof. Huajian Gao	Spring 2018
-ENGN 1750: Advanced mechanics of solids	Prof. Allen Bower	Fall 2018

- Design the structure of water channels in small scale by solving high order partial differential equations.
- Test the mechanical properties of the designed water channels using numerical simulations.

Graduate Student in Solid Mechanics *09/2011- 07/2013*

Key Words: **Contact Mechanics**; **Theoretical Modeling**

- Studied the beginning stage of plasticity under Hertzian contact using an extended elasticity mechanics model.
- Studied the influence of pre-stress on initial plasticity using the similar model above.

HONORS AND AWARDS

● National Scholarship, 2008, 2009.
● National Scholarship for Encouragement, 2010.
● The Scholarship in the name of *Tang Zhaoqian*, 2011. (For the top 2 graduates in the Dept.)
● The First Prize in the Competition of Fundamental Mechanics in Shaanxi Province, 2008.
● The Second Prize in the Mathematical Contest of Modeling of XJTU twice, 2009, 2010.

OVERSEA TRAVELLING HISTORY

- Providence, RI, USA *08/2013- 05/2015* No companion
- 7. **Bo Ni** , Huajian Gao (2020). A deep learning approach to the inverse problem of modulus identification in elasticity. *under review*
- 8. Guoxin Cao , Yunpeng Renb , **Bo Ni** , Tao Wang , Zhuo Zhuang (2020). Indentation response of freestanding two-dimensional materials with an adhesive boundary condition. *under review*
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- 6. Kai Guo* , **Bo Ni*** , Huajian Gao (2020). Tuning crack-inclusion interaction with an applied T-stress. *International Journal of Fracture, 1-11* (*Co-first authors)
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- 4. **Bo Ni** , Huajian Gao (2020). Engineer Energy Dissipation in 3D Graphene Nanolattice Via Reversible Snap-Through Instability. *Journal of Applied Mechanics*, 87(3)
- 3. **Bo Ni*** , Teng Zhang* , Jiaoyan Li , Xiaoyan Li , Huajian Gao (2019). Topological design of graphene. *Handbook of Graphene, Volume 2: Physics, Chemistry, and Biology*, Chapter 1 (*Co-first authors).
- 2. Jiaoyan Li , **Bo Ni** , Teng Zhang , Huajian Gao (2018). Phase field crystal modeling of grain boundary structures and growth in polycrystalline graphene. *Journal of the Mechanics and Physics of Solids*, 120, 36-48
- 1. Emily Hacopian* , Yingchao Yang* , **Bo Ni*** , Yilun Li , Xing Li , Qing Chen , Hua Guo , James Tour , Huajian Gao , Jun Lou (2018). Toughening Graphene by Integrating Carbon Nanotubes. *ACS nano*, 12(8), 7901-7910 (*Co-first authors).
- - Serve as **reviewer** for *Physics Review Letter (PRL)*, *Journal of the Mechanics and Physics of Solids (JMPS)*, *Physics Review B (PRB), Modelling and Simulation in Materials Science and Engineering (MSMSE)*, *Journal of Materials Research (JMR)*.
- - Assist the advisor in **grant writing** for the application of National Science Foundation (NSF) Award #1634492, titled topological design of tough multi-functional 2D materials.