WEN LUO

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EDUCATION

Northwestern University (Evanston, IL, USA) *Sept 2014 - Present*
M.S. and Ph.D. in Theoretical and Applied Mechanics GPA 3.8/4.0
Advisor: Prof. Zdeněk. P. Bažant

Northwestern Polytechnical University (Xi'an, P.R.China) *Sept 2010-June 2014*
B.Eng in Flight Vehicle Manufacturing Engineering GPA 86/100

RESEARCH EXPERIENCE

Statistical Size Effect of RC Beams Under 4-point Bending June 2018 - present (ongoing)
Graduate Research Assistant

- Developed a numerical model using Abaqus with Microplane Model M7 (VUMAT user subroutine) that allows random material parameter input to conduct Monte Carlo simulations of the 4-point bending of reinforced concrete (RC) beams for up to 10^4 times.
- Introduced the distributions of sample p-quantiles into the development of the theory of the size dependence of the coefficient of variation (CoV) of the nominal shear strength.

Strength Distribution of Architected Nanomaterials Jan 2019 - present (ongoing)
Graduate Research Assistant

- Extended the fishnet statistics to the strength distribution of architected nanomaterials (octet carbon nanolattice).
- Compared the strength distribution of the octet lattice with that of a fishnet of same amount of links.

Fishnet Statistics — Strength Distribution of Nacre-like Materials Sept 2016 - August 2019
Graduate Research Assistant

- Developed an analytical model using asymptotic power series expansion to predict the failure probability of nacre-like staggered structures with brittle bonds, especially for the lower tail of the strength distributions.
- Developed an analytical model using order statistics to extend the applicability of fishnet statistics to nacre-like materials with quasi-brittle and quasi-ductile bonds.
- Formulated an analytical scaling relation to describe the size dependence of mean structural strength based on the fishnet statistics, which can be used in tests to validate the fishnet statistics theory experimentally.
- Developed a finite element code in Matlab that could run millions of Monte Carlo simulations within a few days, which then has been used to successfully verify the fishnet statistics theory.

High-Rate Dynamic Comminution of Concrete Under Impact Dec 2017 - Sept 2018
Graduate Research Assistant

- Applied the Microplane model M7 with scaled stress-strain boundaries to the simulation of oblique projectile impact into concrete targets with various oblique angles.

Comparison of Peridynamics with Classical Nonlocal Models Sept 2015 - Sept 2016
Graduate Research Assistant

- Derived the dispersion relations of both bond-based and state-based peridynamic materials using the spectral method (Fourier Transform). And compared them with classical integral-type nonlocal models.

· Compared the numerical scheme and stability issues of bond-based peridynamics with finite difference method: showed the similarity between "horizon" and "stencil" and between "micro-modulus" and "finite difference coefficients".

TEACHING EXPERIENCE

Undergraduate Courses
Graduate Teaching Assistant

· EA III (Modeling Engineering Systems with ODE) - Lecturer: Prof. Todd D. Murphey — Fall 2018
· EA II (Structures & Statics) - Lecturer: Prof. Oluwaseyi Balogun — Winter 2017
· ME 327 Finite Element Methods in Mechanics - Lecturer: Prof. Wing K. Liu — Fall 2016

Graduate Courses
Substitute Lecturer | Grader

· Cohesive Fracture and Scaling - Lecturer: Prof. Zdeněk. P. Bažant — Fall 2017
· Stability of Structures - Lecturer: Prof. Zdeněk. P. Bažant — Spring 2017

Northwestern Searle Teaching Certificate Program — Fall 2019

· Analyze and reflect on teaching pedagogy and evaluation techniques; Develop a course design project; Receive feedback on teaching from faculty mentors and peer.

JOURNAL PUBLICATIONS

Luo, W. and Bažant, Z.P., 2019. Fishnet statistical size effect on strength of materials with nacreous microstructure. *Journal of Applied Mechanics*, 86(8), p.081006.

Luo, W., Chau, V.T. and Bažant, Z.P., 2019. Effect of high-rate dynamic comminution on penetration of projectiles of various velocities and impact angles into concrete. *International Journal of Fracture*, pp.1-11.

Luo, W. and Bažant, Z.P., 2018. Fishnet model with order statistics for tail probability of failure of nacreous biomimetic materials with softening interlaminar links. *Journal of the Mechanics and Physics of Solids*, 121, pp.281-295

Luo, W. and Bažant, Z.P., 2017. Fishnet model for failure probability tail of nacre-like imbricated lamellar materials. *Proceedings of the National Academy of Sciences*, 114(49), pp.12900-12905.

Luo, W. and Bažant, Z.P., 2017. Fishnet statistics for probabilistic strength and scaling of nacreous imbricated lamellar materials. *Journal of the Mechanics and Physics of Solids*, 109, pp.264-287.

Bažant, Z.P., **Luo, W.**, Chau, V.T. and Bessa, M.A., 2016. Wave dispersion and basic concepts of peridynamics compared to classical nonlocal damage models. *Journal of Applied Mechanics*, 83(11), p.111004.

CONFERENCE PROCEEDINGS

Bažant, Z.P., Rasoolinejad, M., Dönmez, A. and **Luo, W.**, 2019, August. Dependence of fracture size effect and projectile penetration on fiber content of FRC. In IOP Conference Series: Materials Science and Engineering (Vol. 596, No. 1, p. 012001). IOP Publishing.

Bažant, Z.P. and **Luo, W.**, 2018. Fishnet model for failure probability of nacre-like imbricated lamellar materials and Monte Carlo verification. In Computational Modelling of Concrete Structures (pp. 73-78). CRC Press.

CONFERENCE PRESENTATIONS

"Quasibrittle failure probability at 10^{-6} Tail: fishnet model for nacreous material architecture and its scaling. Society of Engineering Science (SES) Anual Technical Conference, Washington University in St. Louis, MO"(*Prager Medal Symposium Section Keynote*) *10/14/2019*

"Fishnet statistical size effect on strength of materials with nacreous microstructure.", Engineering Mechanics Institute (EMI) Conference, Caltech, Pasadena, CA *06/20/2019*

"Fishnet probabilistic model for the strength distribution of nacre-like biomimetic materials: from extreme value theorem to order statistics", the Bridging the Gap seminar by Northwestern University student chapter of Society for Industrial and Applied Math (SIAM), Evanston, IL *06/03/2019*

"(Poster) Inferring the strength distribution of nacreous Materials from statistical size effect", Uncertainty Quantification in Computational Solid and Structural Materials Modeling (USACM-UQ), Baltimore, MD *01/17/2019*

"Concrete fragmentation driven by kinetic energy of forming particles", The 13th World Congress in Computational Mechanics (WCCM) 2018, New York City, NY *07/25/2018*

"Fishnet model with order statistics for the tail probability of failure of nacreous biomimetic materials with softening interlaminar links", Engineering Mechanics Institute (EMI) Conference, MIT, Cambridge, MA *04/27/2018*

"Fishnet statistics for scaling and strength of nacre-like imbricated lamilar materials", International Mechanical Engineering Congress & Exposition (IMECE), Tampa, FL *11/09/2017*

FELLOWSHIP AND AWARDS

Northwestern Terminal Year Cabell Fellowship — Fall Quarter 2019

Student Travel Award - USACM Conference on UQ — Winter Quarter 2019

COMPUTATIONAL SKILLS

Programming Languages MATLAB, Mathematica, Fortran, C/C++ (Eigen), Python, Bash
FEM Software ABAQUS: UMAT, VUMAT, Python Scripting Post-processing