

# Xiwei Pan

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📍 Dalian, China

## Education

- Dalian University of Technology** Sep 2022 – Present  
*M.Sc. in Computational Mechanics; Supervisor: Prof. Yichao Zhu in Xu Guo's Group* **Average Score: 91.2/100**
- Topology Optimization and Material Design (94), Structural Optimization Theory (94), Functional Analysis and Variational Principles in Mechanics (94), Mathematical Equations (99), Mathematical Statistics (90).
- Dalian University of Technology** Sep 2018 – Jun 2022  
*B.Eng. in Engineering Mechanics (Qian Lingxi Excellence in Education Program)* **Average Score: 90.2/100**
- Tensor Analysis and Continuum Mechanics (99), Plasticity (98), Finite Element (98), Advanced Finite Element (97), Elastic Mechanics (97), Methods of Mathematical Physics (96), Mechanics of Plate and Shell (96), Functional Analysis & Variational Principles in Mechanics (95), Theory and Method of Structural Optimization (90).

## Research Interests

- Multiscale Modeling, Data-Driven Metamaterial Design, Topology Optimization, Machine Learning Approaches for Mechanical Design/Analysis, AI4Science, Asymptotic Analysis, Plate and Shell Theories.

## Publications

- **Pan X**, Zhou Z, Ma C, Li S, Zhu Y. Machine-Learning-Based Asymptotic Homogenisation and Localisation Considering Boundary Layer Effects. *Int J Numer Methods Eng.* 2024; 125(1):e7367. doi: [10.1002/nme.7367](https://doi.org/10.1002/nme.7367)
- **Pan X**, Zhu Y. Asymptotic Formulation of the Role of Shear Loads on Multi-Layered Thin Shells and Classification of Their Deformation Modes. *arXiv e-prints*, page [arXiv:2407.21021](https://arxiv.org/abs/2407.21021), July 2024. (under review)

## Academic Conferences

- The 16<sup>th</sup> World Congress on Computational Mechanics (WCCM 2024)** Vancouver, Canada
- English oral presentation on *Machine-Learning-Based Asymptotic Analysis of Boundary Layer Effects*.
- The Asian Congress of Structural and Multidisciplinary Optimization (ACSMO 2024)** Zhengzhou, China
- English oral presentation on *Machine-Learning-Based Asymptotic Analysis of Boundary Layer Effects*.
- The Chinese Conference on Computational Mechanics (CCCM 2023)** Dalian, China
- Presentation in the form of *poster*.

## Research Experience

- Asymptotic Analysis on Deformation Modes of Multi-Layered Thin Shells** Apr 2023 – Aug 2024  
*Supervised by Prof. Yichao Zhu of Department of Engineering Mechanics of DUT* **Individual Project**
- Developed a MATLAB-based platform for solving leading-order models of linear elastic multi-layered thin shells using isogeometric discretization.
  - Introduced a rule for classifying two types of shell deformation modes and determined the specific orders of key quantities for both cases.
  - Demonstrated in contrast to existing arguments, a leading-order shell theory derived from asymptotic analysis suffices to predict shell stiffness and internal stress distribution without the inclusion of transverse shear stresses for analyzing applied shear loads of appropriate order of magnitude.
- Machine-Learning-Based Asymptotic Analysis of Boundary Layer Effects** Feb 2022 – Apr 2023  
*Supervised by Prof. Yichao Zhu of Department of Engineering Mechanics of DUT* **Individual Project**
- Established a new model of the boundary layer (BL) in the asymptotic homogenization method by defining BL cells with external loading conditions imposed on one side and matching conditions with the interior cells imposed on the opposite side.
  - Identified mathematical expressions for the equivalent surface elasticity constants, surface balance equations and surface energy corresponding to periodic and spatially-varying microstructures due to the BL presence.
  - Substantially accelerated the online calculation for boundary-localized quantities. With the use of machine learning,

the original implicit interrelationship between the key localized quantities and the multiple onsite mean-field factors can be represented by neural networks.

#### **National Undergraduate Training Program for Innovation**

Jan 2020 – Apr 2021

*Supervised by Prof. Rui Li of Department of Engineering Mechanics of DUT*

*Team Member*

- Derived the governing equations of the displacements at the central axes of hard layers through the variation of the total elastic energy of the laminated structure.
- Quantitatively revealed the role of the thickness and relative length of the soft adhesive layers, as well as the types of imposed boundary conditions, in splitting the neutral mechanical plane.
- Investigated the effect of shear energy of the soft adhesive layer in comparison to the membrane energy and the bending energy.

#### **Numerical Implementation and Visualization of Space Frame Structures**

Jul 2020 – Nov 2020

*Supervised by Prof. Jun Yan of Department of Engineering Mechanics of DUT*

*Team Leader*

- Developed a general platform for the parallel analysis of space frame structures within the C framework.
- Achieved the strength assessment under complex conditions including dead weight, assembly stress, support settlement, temperature stress, etc., as well as the buckling stability assessment of tie rods.
- Implemented the contour visualization of displacements, bending moments, and shear forces of space frame structures.

### **Awards & Achievements**

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- Learning Excellence Award (Second Prize) in academic year of 2018-2019 and 2019-2020
- First Prize in the 28<sup>th</sup> Dalian Mathematics Competition for College Students (2019)
- First Prize in 11<sup>th</sup> Chinese Mathematics Competition for College Students (Non-Math Majors) in Liaoning (2019)
- Second Prize in the 11<sup>th</sup> Chinese Mathematics Competition for College Students (Non-Mathematics Majors) (2019)
- Learning Excellence Award (First Prize) in academic year of 2020-2021
- **Outstanding Graduates** of Dalian University of Technology, Class of 2022
- **Outstanding Graduate Student** of Dalian University of Technology (2024)

### **Other Academic Experience**

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#### **ACE Sustainable Civil Engineering Summer School at Cardiff University**

**Cardiff, UK**

*Study and Visiting*

*Jul 2019 – Aug 2019*

- Participated in reports on self-healing concrete, coastal engineering, and building information modeling (BIM). Also conducted experiments on concrete strength, hydraulic jump, flocculent settling, and design-make-test.

#### **Huawei Study Group on Data Compression Algorithms**

**Shanghai, China**

*Group Research Program*

*Summer 2021*

- Collaborated on a project on lossless compression for remote sensing images and tested the compression ratios based on the interpolation and projection mapping methods.

#### **Seminar on the Open Source Software MFEM**

**Guangzhou, China**

*Reaching Out Activity*

*Summer 2023*

- Acquired familiarity with the basics and usage of the C++-based MFEM program and gave a presentation on the introduction of non-uniform rational B-spline (NURBS) and isogeometric analysis.

#### **Online Presentation at NTNU Nanomechanical Lab (NML) Group Seminar**

Zoom Meeting

*Reaching Out Activity*

*Oct 01, 2024*

- Invited talk on *Asymptotic Analysis on the Deformation Modes of Multi-Layered Thin Shells*.

### **General Skills**

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**Languages:** English (IELTS: 7.5), Mandarin (native), German (basic)

**Programming Languages:** MATLAB (proficient), Python (functional), C/C++ (functional), HTML (functional), CSS (functional), L<sup>A</sup>T<sub>E</sub>X (proficient)

**Analytical Software:** COMSOL (professional), ABAQUS (professional), ANSYS (functional), Mathematica (professional), Origin (functional), etc.