Xiwei Pan

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Education

Dalian University of Technology Sep 2022 – present

M.Sc. in Computational Mechanics; ***GPA: 4.12/5.00***

Research interests: Multiscale modeling, Topology optimization, Machine learning approaches for mechanical design/analysis, Asymptotic homogenization and localization, Plate and shell theories, Isogeometric analysis

Dalian University of Technology Sep 2018 – Jun 2022

B.Eng. in Engineering Mechanics (Qian Lingxi Excellence in Education Program); ***GPA: 4.02/5.00***

Relevant coursework: 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 and Variational Principles in Mechanics (95), Theory and Method of Structural Optimization (90)

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

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, July 2024. (under review)

Research Experience

Numerical Implementation and Visualization of Space Frame Structures

Group Research Program (Team Leader) *Jul 2020 – Nov 2020*

- Developed a general platform for the parallel analysis of space frame structures within the C programming language 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 the space frame structures.

Mechanical Modeling of Soft-Hard Laminated Structures

National Undergraduate Training Program for Innovation and Entrepreneurship *Jan 2020 – Apr 2021*

- 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.

Machine-Learning-Based Asymptotic Analysis of Boundary Layer Effects

Research Program *Feb 2022 – Apr 2023*

- 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.

Asymptotic Analysis on the Deformation Modes of Multi-Layered Thin Shells

Research Program *Apr 2023 – Jul 2024*

- Explored the intrinsic hierarchy within the displacement field, stress components, constitutive law, and momentum conservation due to shell thinness through asymptotic analysis, enabling the formulation of both overall stiffness and key stress components in a fully rational manner.
- Identified two types of shell deformation patterns through a detailed analysis of the order of non-dimensional maximum principal curvature and determined the specific orders of key quantities for both cases.
- Demonstrated in contrast to existing arguments, that 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.

Awards & Achievements

Learning Excellence Award (Second Prize) in academic year of 2018-2019

Learning Excellence Award (Second Prize) in academic year of 2019-2020

First Prize in the 28th Dalian Mathematics Competition for College Students (2019)

First Prize in the 11th Chinese Mathematics Competition for College Students (Non-Mathematics Majors) in Liaoning Province (2019)

Second Prize in the 11th 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

Academic Conferences

The Chinese Conference on Computational Mechanics (CCCM 2023) Dalian, China
- Poster Session.

The Asian Congress of Structural and Multidisciplinary Optimization (ACSMO 2024) Zhengzhou, China
- Oral Lecture Session.

The 16th World Congress on Computational Mechanics (WCCM-PANACM 2024) Vancouver, Canada
- Oral Presentation.

Extracurricular Experience

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
Subject Group Communication *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.

General Skills

Languages: English (IELTS: 7.5, with L: 8.0, R: 9.0, W: 7.0, S: 6.5), Mandarin (Native), German (Basic)

Programming Languages: MATLAB, C/C++, `HTML`, CSS, LaTeX

Analytical Softwares: COMSOL, ABAQUS, ANSYS, Mathematica, Origin, etc.

MS-Office Softwares: Word, Excel, PowerPoint, etc.