武 思蒙

Solid Mechanics/Dept. of Mechanics & Aerospace Eng.

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Education

IX 2018 –VII 2022 **Theoretical and Applied Mechanics**, *Bachelor of Science*, Dept. of Mechanics & Aerospace Eng., SUSTech.

IX 2022 –Now **Mechanics**, *PhD*, Dept. of Mechanics & Aerospace Eng., SUSTech.

Personal Information

UG Courses : Math : Mathematical Analysis, Complex Analysis, Real Analysis, Functional Analysis, ODE-B, PDE, PDE-1(graduate), Differential Geometry, Prob. & Stat. ;
Mech : Theoretical Mechanics-A, Mechanics of Materials, Elasticity, Fluid Dynamics, Aerodynamics, Thermodynamics, Variational Method, etc

PG Courses(so far) : Math : Methods of Applied Math ;
Mech : Advanced Numerical Methods

Tools & Softwares : Python, MATLAB pdetool, Sfepy, FreeFem++, Netgen/NGSolve

About Me

It can be seen from my UG transcript that I have a solid background in both applied mathematics and mechanics. I can deal with complex material in a systematic way, for example, using variational framework to derive equations, using homogenization theory to simplify the original problem and develope finite element codes for numerical simulations.

I'm curous about the Machine Learning since I have no idea how to implement it by my hands.

Besides, I'm eager to share my own ideas on some problems and make them available on the Internet. I write some interesting essays related with my research areas on the site give on the left hand side of my portrait. Besides, I'm preparing a seminar on geometrical and analytical methods in *Nonlinear Elasticity*. Feel free to contact me with Email if that seminar catch your eyes !

Research Areas

Effective Properties

— My undergraduate thesis AR(1) exploited a stochastic method to determine the effective moduli of nano composite materials at low volume fractions based on n-point correlation functions.

— I've developed a homogenization algorithm BK(1), AR(2) to determine the effective torsional rigidity of a circular cylinder composed of two phases, namely the strong and weak phases.

Inclusion Problems and Related Optimal Design

— It's already known that the van den Berg's inequality holds. I gave a new physical interpretation AR(3) as an application of this inequality. To some extent, it resembles the Heisenberg uncertainty principle.

— Inspired by the famous Pólya–Szegö inclusion problem in electricity and the Eshelby inclusion problem in elasticity. I considered a circular cylindrical bar with a circular inclusion inside, for which the modulus of the inclusion is 0 for a "hole", ∞ for a rigid inclusion and $Const.C$ for another material.

Continuum Mechanics

— A common derivation of the equilibrium equation of linearized elasticity is by analysing the forces on each surface of the so-called "infinitesimal hexahedron" representing some "point" in the continuum body. I used variational method BK(2) based on strain energy, which seems more plausible, to deduce the same equation AR(4) by rigorous mathematical analysis.

Fracture Mechanics

— I'm trying to develope a quasiperiodic perturbation method in phenomenological macroscopic fracture mechanics based on theory of homogenization.

Selected Publications

BOOKS

BK(1) W. Simeng, **Homogenization of Elliptic Operators —in Modern Perspective**, Github, April, 2022.

BK(2) W. Simeng, **Variational Method, Finite Element Implementation and Their Applications to Liquid Crystal Elastomers**, Github, June, 2022.

ARTICLES

AR(1) W. Simeng, **The effective mechanical properties of 2-phase composite materials**, Github, June, 2022.

AR(2) W. Simeng, **On the effective tortional rigidity of a 2-phase composite cylindrical bar**, Unpublished.

AR(3) W. Simeng, **Thermo-Rigidity constraint principle**, Github, February, 2022.

AR(4) W. Simeng, **Derivation of linearized elasticity system using variational analysis**, Github, August, 2022.

Hobbies

— studying Français,

— playing badminton, volleyball and soccer,

— reading academic books,

— games, e.g., SIMs(simulation management games), LOL, minesweeper.