

**Fucheng TIAN**

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**RESEARCH INTERESTS**

1. Phase field modeling of fracture at large deformations;
2. Fracture physics and flow instability;
3. Advanced algorithms (adaptive mesh, meshfree, machine learning, etc.)

**EDUCATION**

**Ph. D**. Nuclear Science and Technology **Supervisor:** Prof. Liangbin Li

University of Science and Technology of China (USTC), Hefei, China 09/2015 - 06/2020

**Research Area**: Numerical simulation of nonlinear fracture and flow instability

**B. S.** Engineering Mechanics. Top 10% in the college of engineering mechanics.

Zhengzhou University (ZZU), Zhengzhou, China 09/2011 - 06/2015

**WORK EXPERIENCE**

**Postdoc**. Solid Mechanics **Co-advisor:** Prof. Liangbin Li

University of Science and Technology of China (USTC), Hefei, China 06/2020 – at present

**Research Area**: Soft material mechanics

**RESEARCH ACTIVITIES**

* **Fracture physics at large deformations 12/2018 -at present**

1. Reformat and program the phase field model of the quasi-static fracture in the framework of finite deformations (*ha*-PFM V2.0).
2. Investigate the effect of crack tip hyperelasticity on dynamic crack propagation stability (*ha*-PFM V2.1).
3. Couple edge-based smoothed FEM (ES-FEM) and PFM to deal with complex cracks in large deformations (*ha*-PFM V3.0).
4. Study the transonic fracture of the soft materials.

* **Phase field modeling of quasi-static and dynamic brittle fracture 07/2017 - 11/2018**

1. Propose a novel hybrid adaptive finite element phase-field method (*ha*-PFM) to solve brittle fracture problems under quasi-static and dynamic loading.
2. Develop a FEM solver for linear elastic fracture based on the variation phase field method (*ha*-PFM V1.0).
3. Reveal the bifurcation criterion and the origin of limit crack velocity in dynamic brittle fracture.

* **Hydrodynamic instability of viscoelastic fluids 09/2015 - 06/2017**

1. The stabilization techniques [discrete elastic viscous stress splitting (DEVSS) and streamline upwind Petrov–Galerkin (SUPG)] were first introduced into the 2D film model.
2. Develop a FEM solver for multi-field (velocity field, stress field, temperature field) coupling of viscoelastic fluids (PolyLab V1.0).
3. Conduct the stability analysis of film casting based on a wider parameter space of processing and the rheological properties of the polymer melt.

**PUBLICATIONS**

1. **Fucheng Tian**, et al. Nonlinear stability and dynamics of nonisothermal film casting*.* ***Journal of Rheology* 62, 49 (2018)**
2. **Fucheng Tian,** et al. A hybrid adaptive finite element phase-field method for quasi-static and dynamic brittle fracture. ***Int J Numer Methods Eng.* 2019**
3. **Fucheng Tian**, et al. Bifurcation criterion and the origin of limit crack velocity in dynamic brittle fracture. ***International Journal of fracture*** (**2020**)
4. **Fucheng Tian**, et al. An adaptive edge-based smoothed finite element method (ES-FEM) for phase field modeling of fractures at large deformations. ***Computer Methods in Applied Mechanics and Engineering*, 2020**
5. **Fucheng Tian,** et al. A dynamic phase field model with no attenuation of wave speed for rapid fracture instability in hyperelastic materials. ***International Journal of Solids and Structures*. 2020**
6. **Fucheng Tian**, et al. Mixed displacement-pressure-phase field framework for finite strain fracture of nearly incompressible hyperelastic materials. arXiv preprint arXiv:2112.00294, **2021 (CMAME accepted)**
7. Mengnan Zhang, Erjie Yang, Jun Zeng, Jiale Ji, **Fucheng Tian\***, Liangbin Li\*. Numerical study on oblique stretching of viscoelastic polymer film. ***Journal of Non-Newtonian Fluid Mechanics***, **2021**, 295: 104597.
8. Jun Zeng, Mengnan Zhang, Erjie Yang, **Fucheng Tian\***, Liangbin Li. A tracking strategy for multi-branched crack tips in phase-field modeling of dynamic fractures. ***International Journal for Numerical Methods in Engineering***, **2021**.

**SOFTWARE PORTFOLIO**

**Platform: windows/Linux (Ubuntu); Programming language: Matlab &C++ (mex)**

* ***h*a-PFM (V1.0-3.0)- explicit/implicit phase field solver for fracture based on hybrid adaptive mesh**
* Implicit/explicit solver for quasi-static and dynamic fracture of brittle/rubber-like materials.
* Hybrid adaptive mesh refinement and coarsening.
* Discretization via FEM and ES-FEM (in large deformations).
* Parallel assembly, sparse storage.
* **PolyLab (V1.0-2.0)- Finite element solver for polymer fluids**
* FEM solver for steady-state and transient viscoelastic fluid flow.
* Multiphysics (velocity field, stress field, temperature field) monolithic solution.

**SKILLS & ABILITIES**

**Academic skills:**

1. Solid knowledge of continuum mechanics, constitutive theory and phase field modeling of fracture.
2. Deep understanding of finite deformation theory, non-linear FEM, S-FEM, adaptive mesh algorithm, explicit/implicit solution algorithms.
3. Skilled in writing codes of FEM and S-FEM involving solid/non-Newtonian fluids.
4. Familiar with Matlab, C++.
5. FEA/CAD software: ANSYS, CREO; Open-source software: Moose.

**PERSONALITY**

Optimistic; Energetic and enthusiastic; Enjoy writing code