A Variational Framework for Phase-Field Fracture Modeling with Applications to Fragmentation, Desiccation, Ductile Failure, and Spallation Dissertation Defense

Tianchen (Gary) Hu

Department of Mechanical Engineering & Materials Science Pratt School of Engineering Duke University

Committee:

John Dolbow
Wilkins Aquino
Johann Guilleminot
Manolis Viveakis
Benjamin Spencer

July 15th, 2021

Overview

Introduction

Background Research contributions

The Variational Framework

Kinematics and Constraints Thermodynamics Te variational statement

Applications

Intergranular Fracture in Polycrystalline Materials Soil Desiccation Towards Ductile Fracture

Conclusions and Future Work

Conclusions Future work

Background

Research contributions

The Variational Framework

Kinematics and Constraints

Te variational statemen

Applications

Intergranular Fracture in Polycrystalline Materials Soil Desiccation

Towards Ductile Fracture

Conclusions and Future Work

Conclusions

Fracture is a common phenomenon in engineering applications.

We would like to understand fracture.

To characterize fracture by its development lifecycle: defects, nucleation, propagation, branching, merging.

Background
Research contributions

The Variational Framework Kinematics and Constraints Thermodynamics Te variational statement

Applications

Intergranular Fracture in Polycrystalline Materials
Soil Desiccation
Towards Ductile Fracture

Conclusions and Future Work

Conclusions

The Variational Framework

Thermodynamics

The Variational Framework

Background

Research contributions

The Variational Framework

Kinematics and Constraints Thermodynamics Te variational statement

Applications

Intergranular Fracture in Polycrystalline Materials Soil Desiccation

Towards Ductile Fracture

Conclusions and Future Work

Conclusions

Intergranular Fracture in Polycrystalline Materials

Applications

Introduction

Research contributions

The Variational Framewor

Kinematics and Constrair Thermodynamics Te variational statement

Applications

Intergranular Fracture in Polycrystalline Materials

Towards Ductile Fracture

Conclusions and Future Worl

Applications

Intergranular Fracture in Polycrystalline Materials

- Duke PRATT SCHOOL OF ENGINEERING

Soil Desiccation Applications

Applications

Soil Desiccation

Towards Ductile Fracture

Applications

Introduction

Background

The Variational Framewor

Kinematics and Constraints Thermodynamics Te variational statement

Applications

Intergranular Fracture in Polycrystalline Material Soil Desiccation

Towards Ductile Fracture

Conclusions and Future World

Conclusions

- Duke PRATT SCHOOL OF ENGINEERING

Applications

Background

The Variational Framework

Thermodynamics

Te variational statement

Applications

Intergranular Fracture in Polycrystalline Materials Soil Desiccation

Towards Ductile Fracture

Conclusions and Future Work

Conclusions

Conclusions and Future Work

Conclusions