

Artificial Intelligence-Assisted Modelling of High-Rate Ductile Fracture

Supervisors - Primary: Dr Emmanouil Kakouris, Engineering

Prof. James Kermode, Engineering

Project Partner: AWE-NST

Hello, my name is Emmanuel Kakouris and I'm excited to tell you about a new HetSys PhD project we are offering at the University of Warwick titled Artificial Intelligence Assist Modelling of High Rate Tactile Fracture.

This project is supervised by myself alongside Professor James Kermode, with support from our project partner AWE Nuclear Security Technologies.

When materials fail under high stress, such as during impacts or shock loading, they can break in ways that are difficult to predict. One of the challenges engineers face is understanding how materials deform before breaking, especially when this happens at high rates. This process is called ductile fracture.

It involves the material changing shape in complex ways, such as forming tiny cavities or voids and cracking. Current models often struggle to predict these behaviours accurately, especially when the material is under dynamic high rate loading conditions.

This is where our project comes in. As part of this PhD project, you will develop computational models to better understand how the materials fail under such dynamic conditions.

You will use something called phase field modelling, which is a powerful technique that simulates fracture processes without the need for explicit crack tracking. This allows for more accurate prediction of the material failure under shock or impact.

The project will also incorporate efficient intelligence. AI will help you improve these models by examining the failure modes and measuring the uncertainty in your simulations.

This will allow us to make more reliable predictions for real world applications such as in aerospace, automotive and defence industries.

This PhD will help you develop a solid understanding of material behaviour under stress and you will also gain skills in computational mechanics and programming.

You will learn how to use AI and machine learning techniques for scientific applications, as well as how to use programming languages such as Python and C++ or Fortran to develop and implement these models.

This is an exciting opportunity to make a real impact in the field of engineering while also gaining cutting edge skills in computational methods and AI.

If you are interested or want to discuss the project further, please feel free to contact me.

Thank you for your time and I'll look forward to hearing from you.