JINSUHAI (LUKA) BAI

PHD STUDENT | PROGRAM 1
ARC TRAINING CENTRE FOR JOINT BIOMECHANICS

PhD duration: July 2021 - July 2024

My interests: Research and computational mechanics, particularly at commercial software companies.

BEng (Human University) **MPhil** (QUT)

Supervisors:
Prof. Yuantong Gu, Prof. Emilie Sauret & Prof. You-Gan Wang

PROJECT OVERVIEW

Project Title: Computational mechanics framework based on Physics-Instructed Machine Learning (PIML)

THE PROBLEM

Why to integrate PIML techniques to traditional computational mechanics?
PIML is an emerging technique in Machine Learning (ML) field and has attracted high attention in the scientific computing field. PIML has been demonstrated to be an effective way to solve Partial Differential Equations (PDEs). Computational mechanics is a discipline that leverages numerical methods to solve mechanics problems governed by PDEs. In this manner, PIML can be adopted to the computational mechanics fields and open new avenue for mechanics modelling. We want to explore the integration of PIML and computational mechanics and investigate the new possibilities for computational mechanics field.

How can PIML-based computational mechanics framework help?
The PIML-based computational mechanics opens new avenue for mechanics modelling. PIML brings more flexibility to the computational mechanics fields. By using the PIML, the limitations of the traditional computational mechanics methods can be greatly alleviated or even eliminated. The well-developed PIML-based computational mechanics framework can be used for the problems that are considered to be challenging for traditional computational mechanics methods.

Why does PIML-based computational mechanics framework need more research?
This is a newly proposed area. To establish a reliable, effective and efficient framework, various aspects of the PIML-based computational mechanics framework remain further investigations.

PROJECT AIMS

1. Investigate different aspects of the PIML-based computational mechanics framework.
2. Establish effective and robust PIML-based computational mechanics framework for real applications.

OUR SOLUTION & EXPECTED OUTCOMES:

To achieve my aims, one of the most popular ML technique, Neural Networks, will be used with the help of the knowledge from traditional mechanics side. The framework will be validated by comparing the results from analytical solution or the results from commercial software.
We expect that we can establish an effective and robust PIML-based computational mechanics framework for real applications.

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