Open FDEM Post-Processing

Release 1.0

OpenFDEM 2022

Dec 12, 2022

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ONE

INTRODUCTION

This Python package performs transformations on hybrid finite-discrete element method (FDEM) models with an unstructured grid in vtk/vtu/vtp format. It currently supports arrays of simulation files from the FDEM solvers:

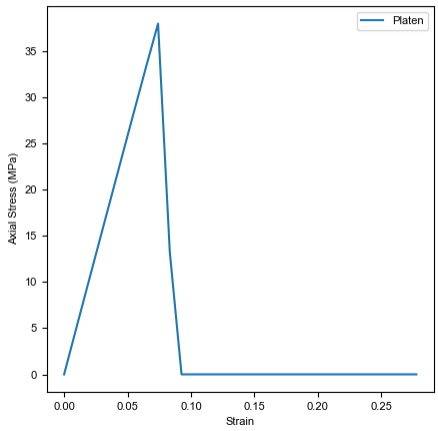
- Geomechanica's Irazu software,
- Y-Geo (and its common derivatives), as well as
- OpenFDEM.

The package is heavily dependent on `pyvista` and is limited to `Python >=3.5, <=3.9`. The package is maintained by the Grasselli's Geomechanics Group at the University of Toronto, Canada, and is part of a collaborative effort by the open-source pacakge OpenFDEM.

1.1 Functionality

The functionality of this script was developed with the objective of extracting common information needed when running simulations. Highlights of the script are:

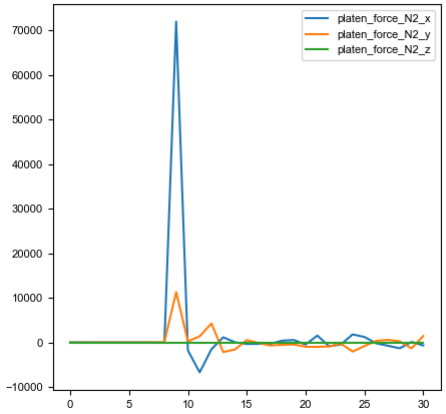
- Extract information within the FDEM Model based on the name of the array (e.g., Stress, Strain, Temperature, etc…) Works in 2D and 3D.
- Extract stress-strain information for UCS and BD Simulations (Works in 2D and 3D). Optional addition of virtual strain gauges (Limited to 2D).
- Plotting stress vs strain curve.



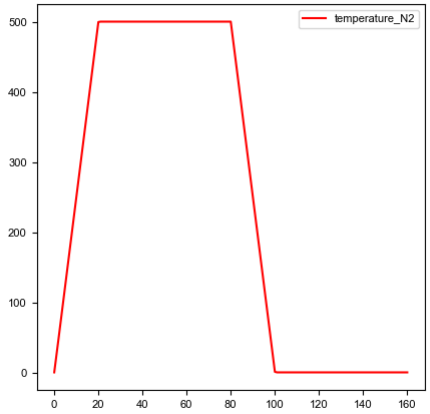
- Calculate the Elastic Modulus of the dataset. Eavg, Esec and Etan can be evaluated. Works in 2D and 3D.

```
# Variants of E tangent
Etan at 50%: 51683.94MPa
Etan at 50% with linear best fit disabled: 51639.22MPa
Etan at 50% using strain gauge data: 50275.03MPa
# Variants of E secant
Esec at 70%: 51681.01MPa
Esec at 50%: 51817.43MPa
# Variants of E average
Eavg between 50-60%: 51594.49MPa
Eavg between 20-70% with linear best fit disabled: 51660.62MPa
```

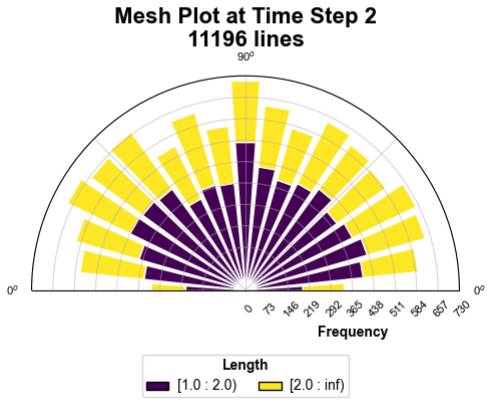
- Extract information of a particular cell based on a sequence of array names. This can be extended to extracting information along a line. Works in 2D and 3D.



- Extract information of a threshold dataset criteria based on a sequence of array names. Works in 2D and 3D.



- Extract mesh information and plot rosette/polar plots. Limited to 2D.



- Automatic detection/ User-defined assigment of loading direction when analysing mechanical simulations, namely UCS, BD, and PLT, in both 2D and 3D simulations.

```
Script Identifying Platen
        Platen Material ID found as [1]
        3D Loading direction detected as [1] is Y-direction
Values used in calculations are
        Area        3721.00
        Length        122.00
Progress: |////////////////////////////////////////////////| 100.0% Complete
```

1.2 Additional Support

Please refer to the user manual for detailed information pertaining to the various functions and their usage/arguments. For specific script requests and bug, please report them on our github page.

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TWO

PYFDEMPP

CHAPTER

THREE

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