

# Magneto-static Analysis of a Brushless DC Motor

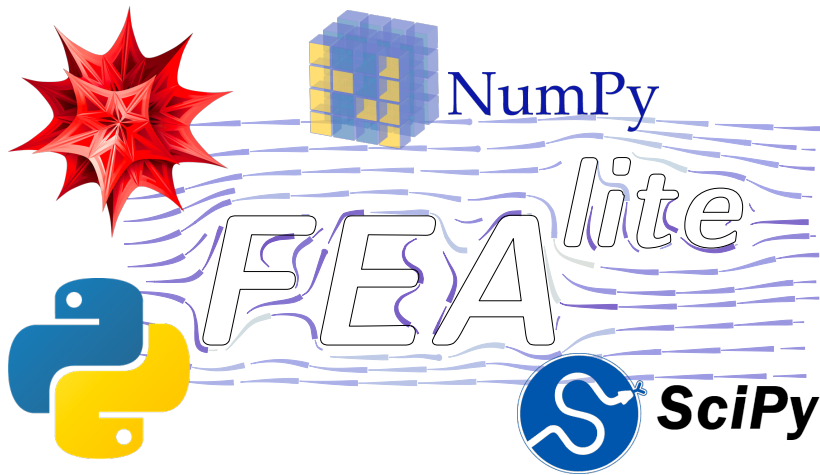
Tom Ginsberg, Brendan Posehn



# Overview

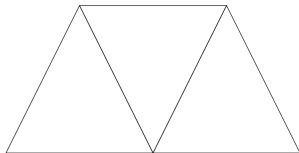
- ▶ Background  
Brushless DC Motors
- ▶ Theory  
Magneto-statics, Permanent Magnets, Non Linear FEM
- ▶ Implementation  
Meshing, Matrix Assembly, Solving, Newton Raphson
- ▶ Results  
Diagrams, Torques

Implementation: FEA*lite*



# Implementation: Mesh Generation

- ▶ Meshes are generated using the Mathematica 12 mesh generator
- ▶ Exported as:
  - list of coordinates  $[x, y]^v$
  - list of mesh elements  $[v_1, v_2, v_3, \text{marker}]^e$
  - list of boundary elements  $[v_1, v_2, \text{marker}]^{be}$



```
# Coordinates-5
0.0000  0.0000
1.0000  0.0000
0.5000  1.0000
2.0000  0.0000
1.5000  1.0000
# Triangle Elements-5
1      2      3      1
2      3      5      1
2      5      4      1
# Boundary Elements-5
1      2      1
2      4      1
4      5      1
5      3      1
3      1      1
```

## Implementation: Mesh