Project Description

- Extend the mathematics of fractional calculus to practical engineering problems involving field transport
- Develop a fractional homogenization technique that can model wave propagation in complex, heterogeneous media

Approach

- Develop approach for elastic wave propagation in a 1D periodic rod
- Determine fractional order of a spatial fractional wave equation using dispersion relationship
- Derive analytical solution of a fractional partial differential equation

Discussion

Two advantages of approach:
- Fractional homogenization method capable of capturing response within frequency band gaps
- Closed-form analytical solution of dynamic response of inhomogeneous periodic media obtained

Results

1. Plot of fractional order

![Plot of fractional order](image)

2. Comparison between analytical solution and finite element results

![Comparison between analytical solution and finite element results](image)

Homogenization models using fractional calculus can well represent the dynamics of complex structures