Theoretical and Computational Acoustics

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Plan

Introduction

General overview

dispersion error
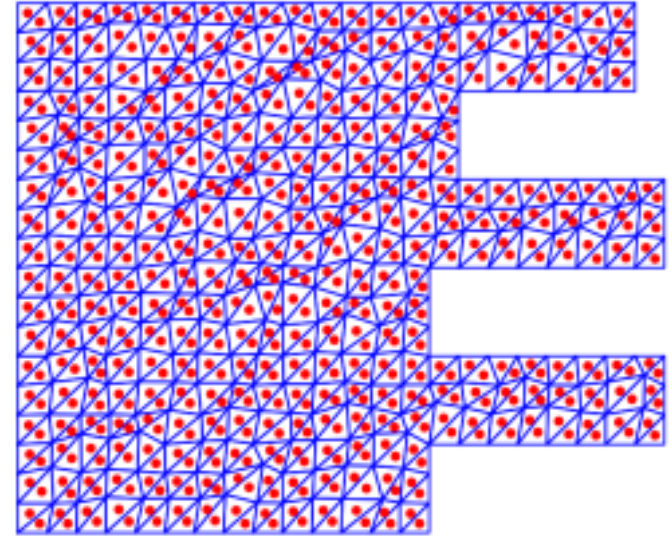
Control of acoustic wave

Conclusion and Perspectives

General overview
Helmholtz equation

$$\Delta u + k^2 u = f, \, in \, \Omega$$
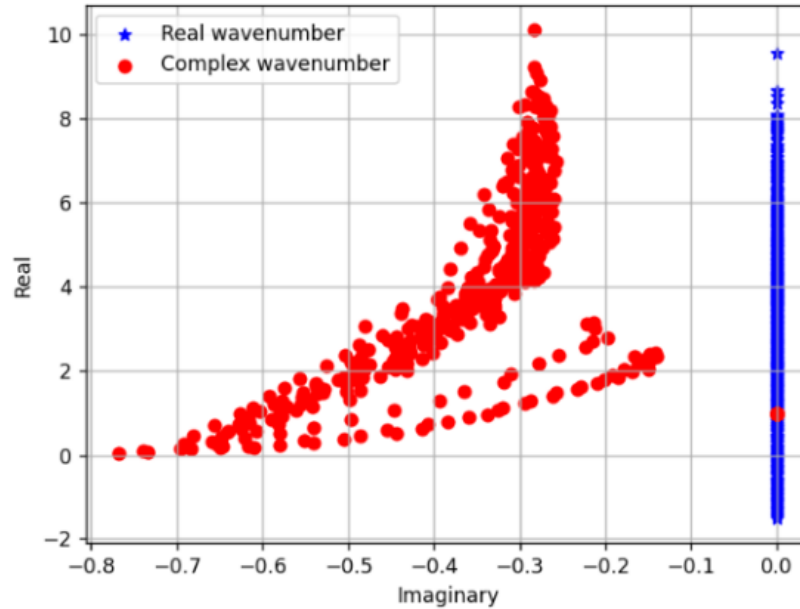
- Dirichlet condition: $u = 0, \, on \, \Gamma_d$

- Neumann condition: $\frac{\partial u}{\partial n} = 0, \, on \, \Gamma_n$

Disturbed comb-like mesh
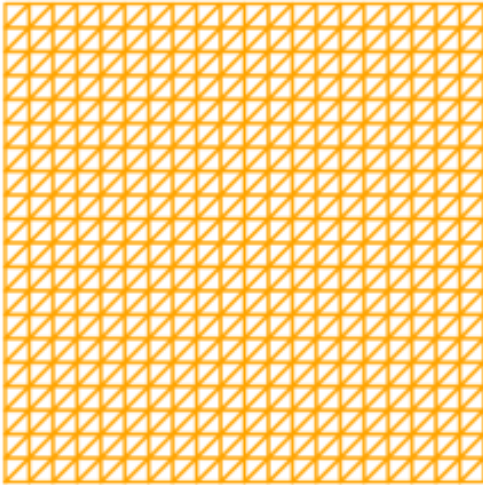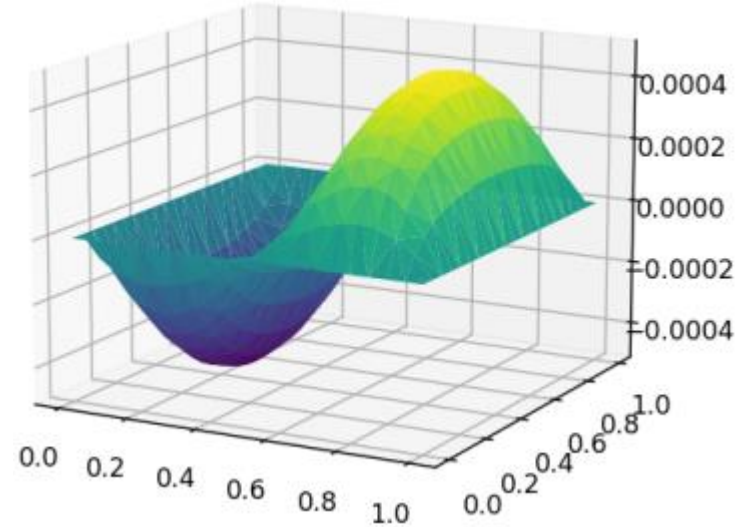
General overview
Solving the equation

Eigen-values for the void and absorbing materials

General overview
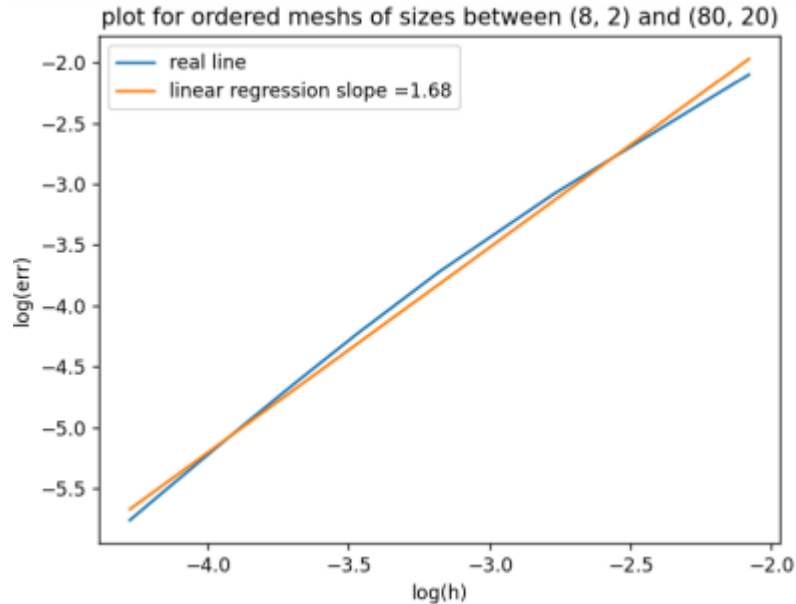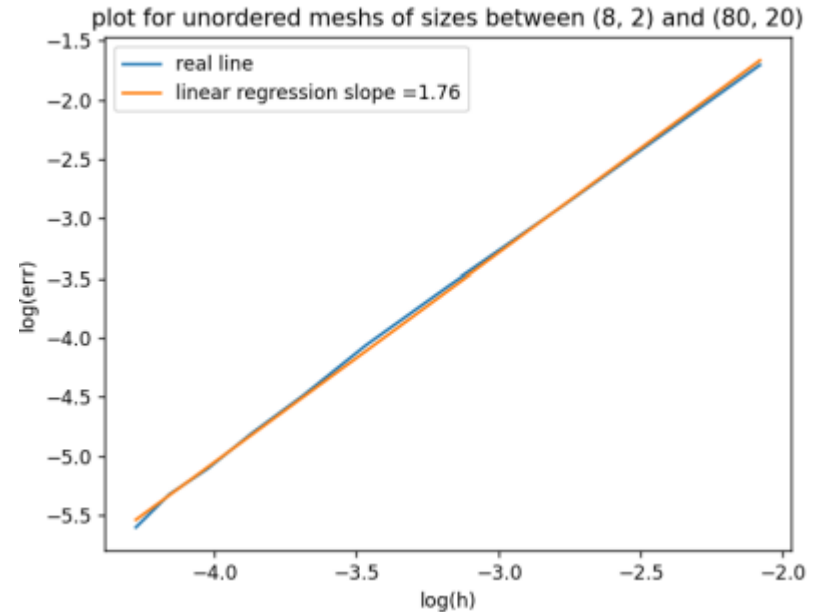## Solving the equation

Simple testing mesh

Real error between modeled and theoretical results

Pollution and dispersion error of the finite element method
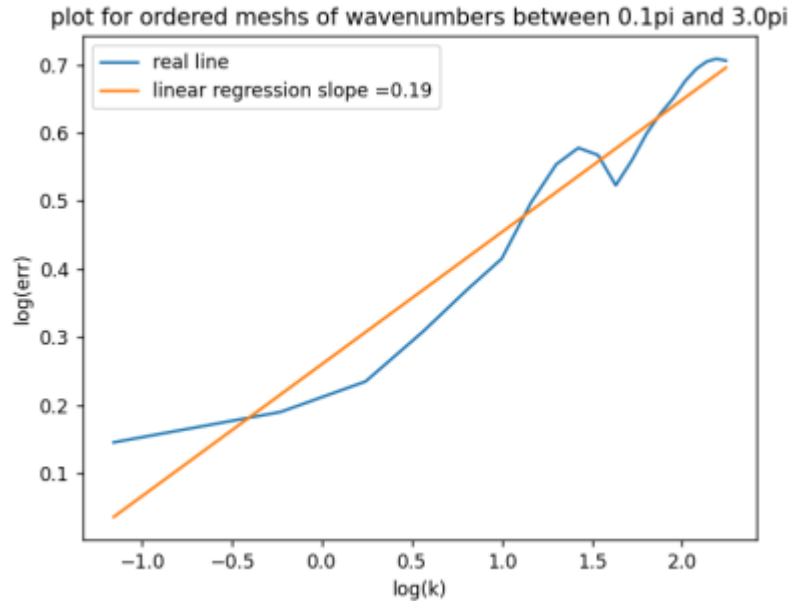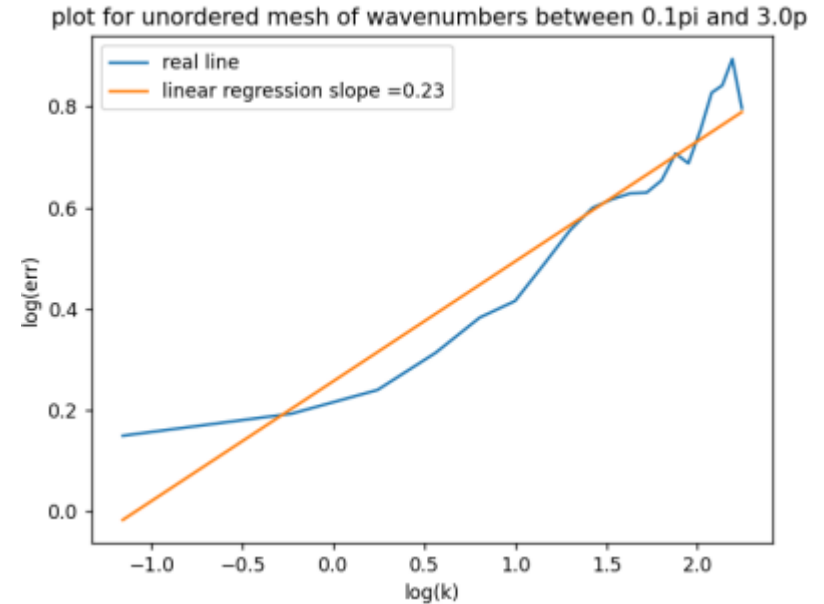## Effects of the step h

linear regression on ordered meshs

linear regression on unordered meshs

Pollution and dispersion error of the finite element method
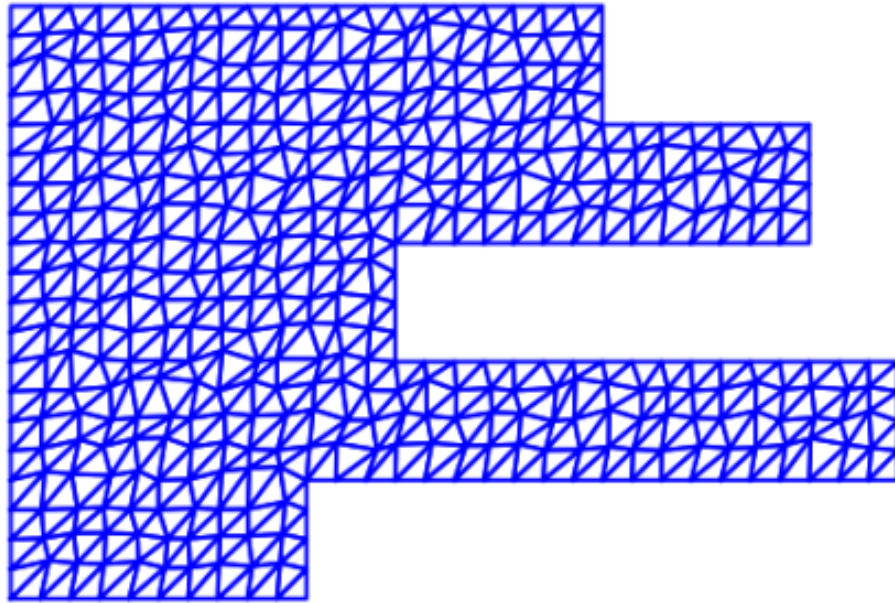## Effects of the wavenumber K

plot for ordered meshs of wavenumbers between 0.1pi and 3.0pi

- real line
- linear regression slope =0.19

plot for unordered mesh of wavenumbers between 0.1pi and 3.0p

- real line
- linear regression slope =0.23

Linear regression on ordered meshs

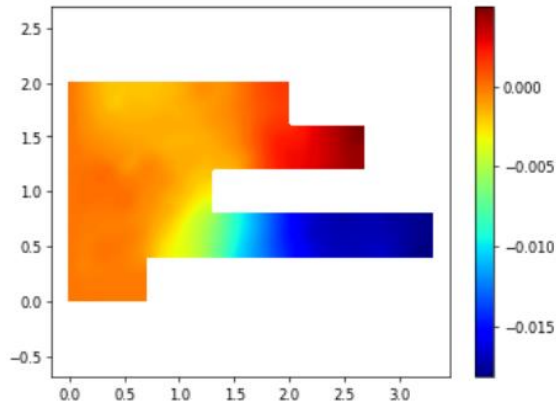Linear regression on unordered meshs

Control of acoustic wave
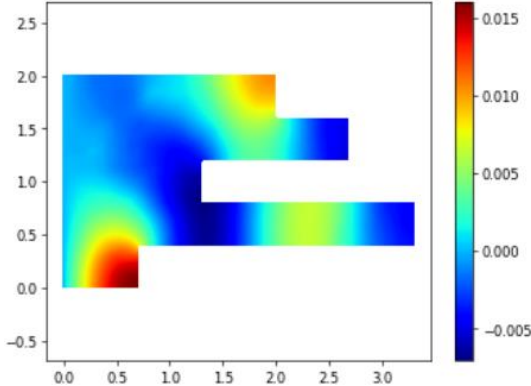## Effect of the frequency
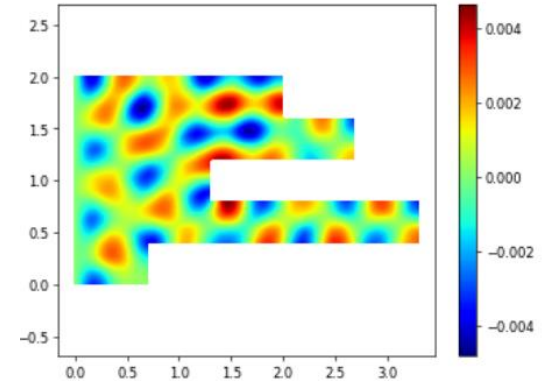
Control of acoustic wave
Effect of the frequency
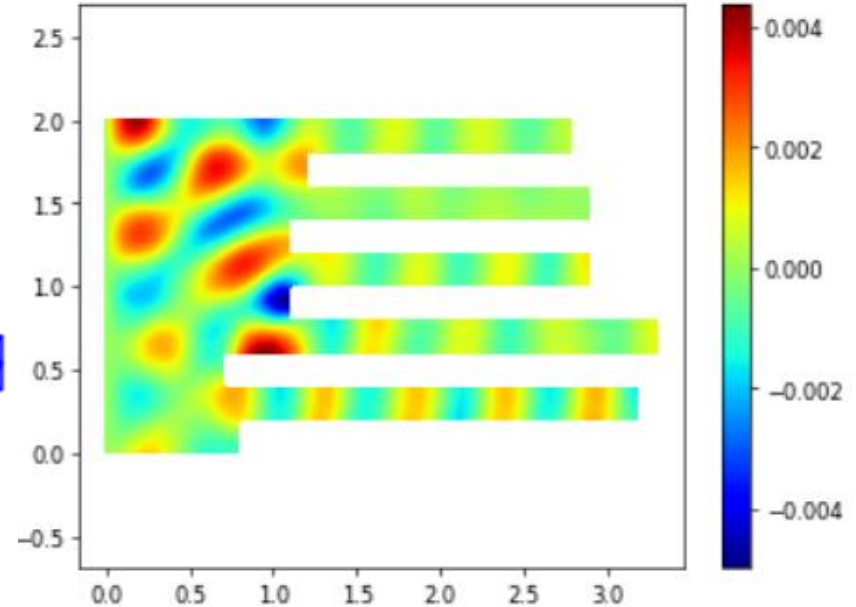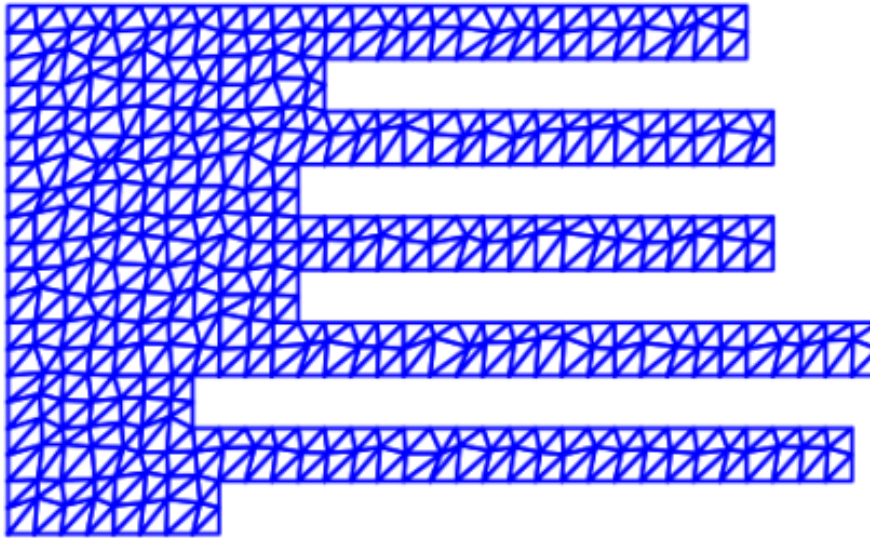

Propagation of wave with a wavelength of 100

Propagation of wave with a wavelength of 2

Propagation of wave with a wavelength of 0,5
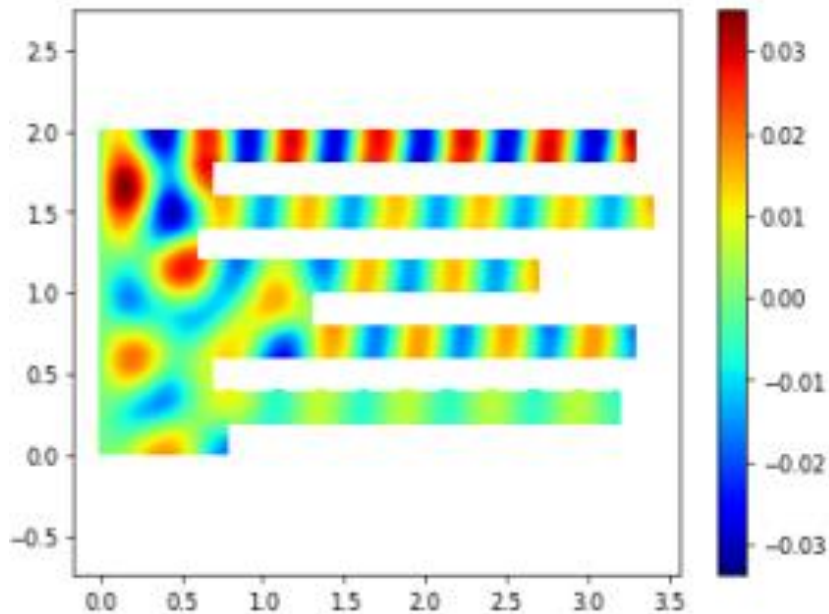
Control of acoustic wave
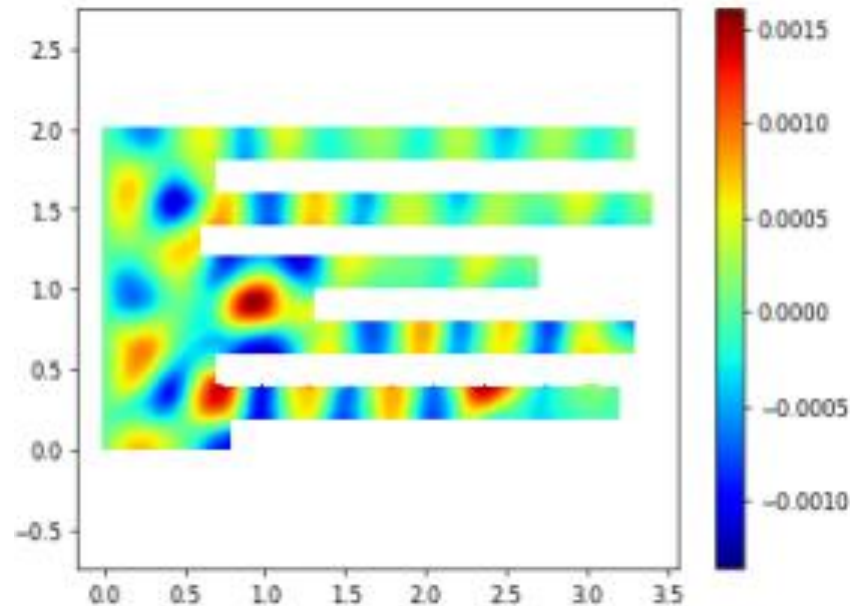## Effect of the frequency on more extreme geometries

Propagation of a wave with a wevelength of 0.5

Control of acoustic wave by changing the geometry on a surface

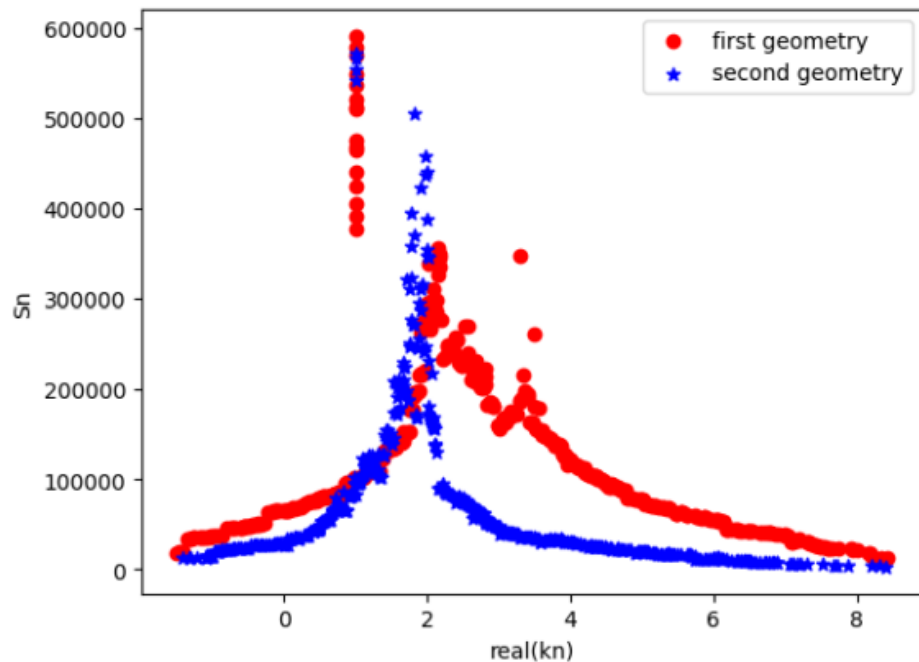## Eigenmodes localizing inside this geometry

Example of localizing mode

Example of unlocalizing mode

Control of acoustic wave by changing the geometry on a surface

Existence surface for different cavities

Existence surface for different geometries