Theoretical and Computational Acoustics

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Plan

Introduction

Quality Analysis
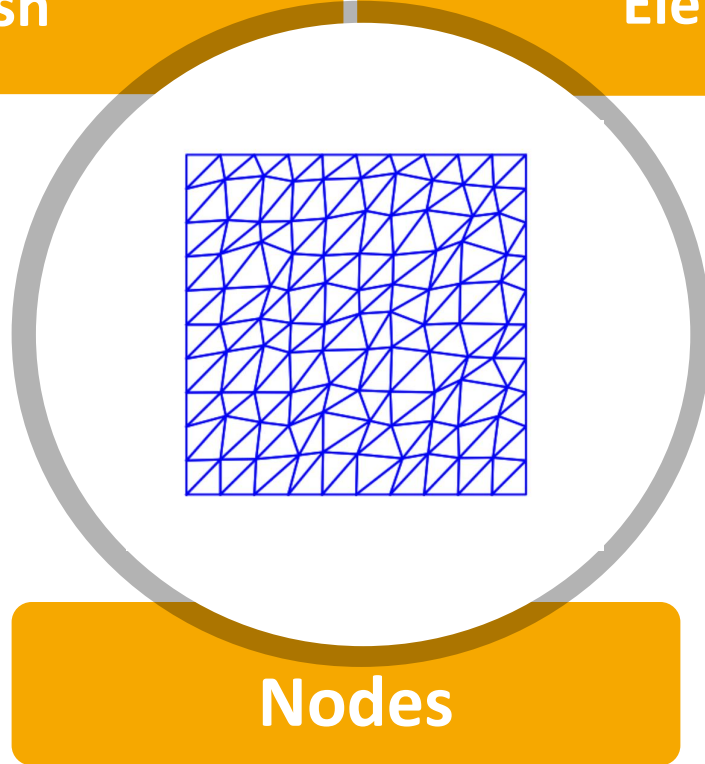
Creating the mesh

Creating the Fractal

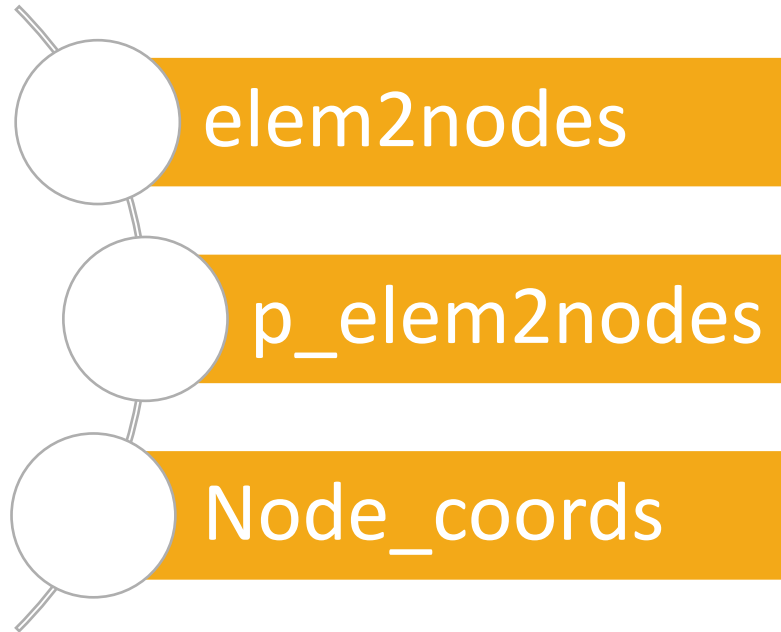Visualization

Conclusion and Perspectives

Defining elements

Mesh

Elements

Nodes

Introduction

- elem2nodes
- p_elem2nodes
- Node_coords

Part 1: Quality Analysis

assuming we already have a complete mesh

Part 1: Quality Analysis
Aspect Ratio Calculation

- Aspect Ratio for triangles

$$Q = \alpha \cdot \frac{h_{max}}{\rho}$$

- Aspect Ratio for quadrangles

$$Q = 1.0 - \frac{\sum_{j=1}^{4} \left| e_j e_{(j+1)\%4} \right|}{4}$$
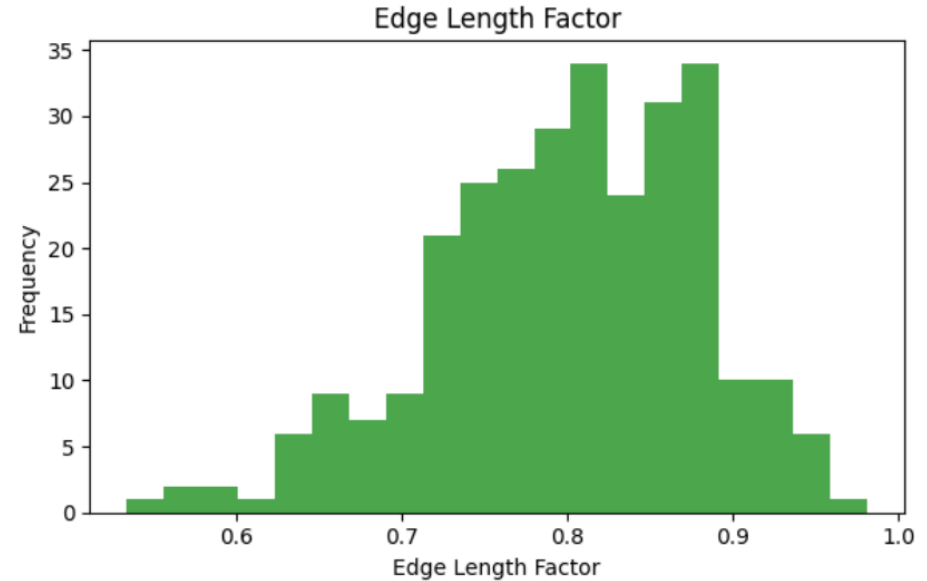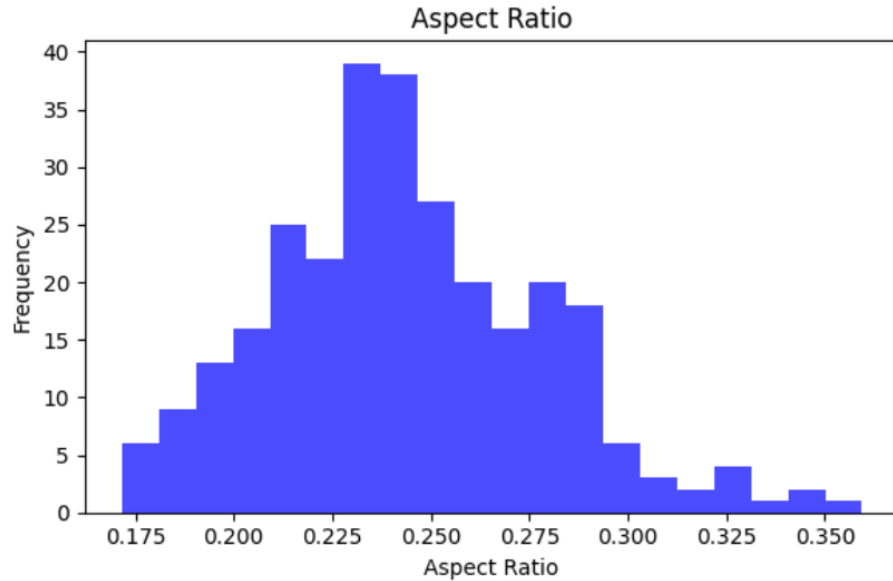
Part 1: Quality Analysis

Edge Length Factor Calculation

$$\frac{\min(edge_i)}{\text{mean}(edge_i)}$$

Part 1: Quality Analysis
Distribution of the quality factor for a given triangular mesh
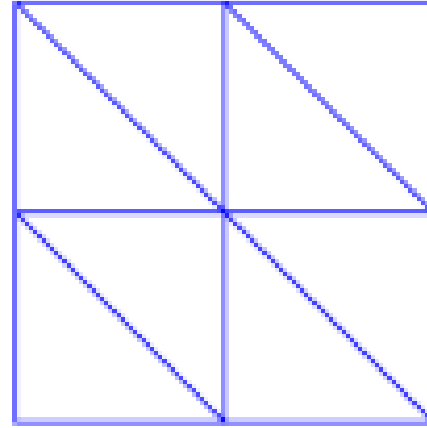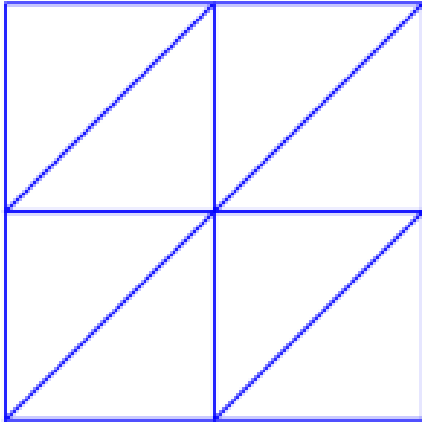
Part 2: Creating the mesh

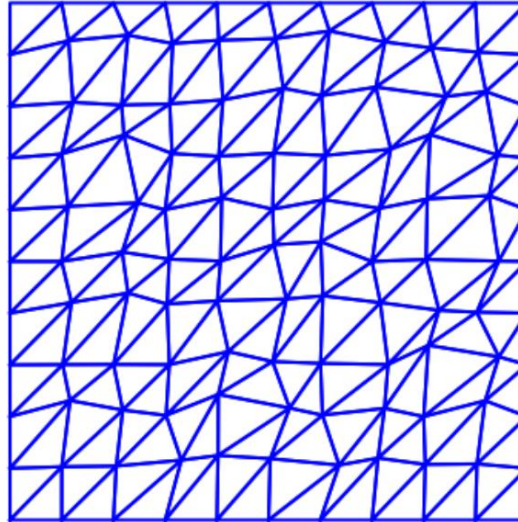Assuming we already have a regular mesh with square elements

Part 2: Creating the mesh

Splitting square elements into triangles

Part 2: Creating the mesh
Shifting internal Nodes in the Mesh

Part 3: Creating the fractal
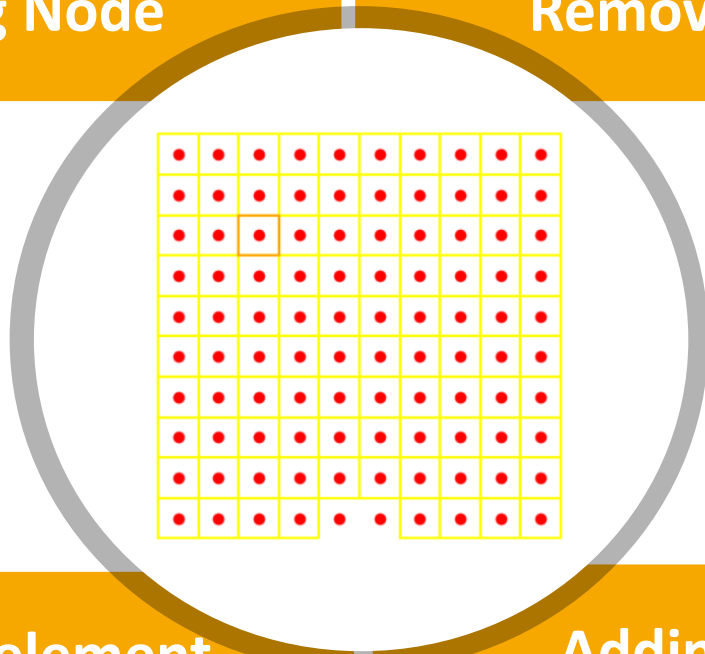
we will utilize the first mesh given to us

Part 3: Creating the fractal
Mesh Manipulation Functions
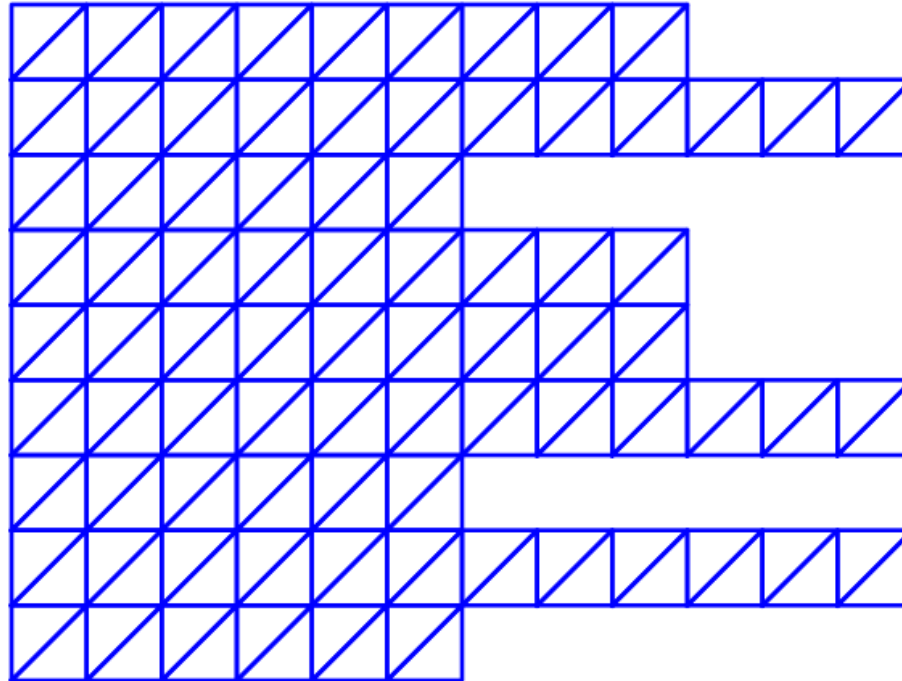
Adding Node

Removing Node

Adding element

Adding Node

Part 3: Creating the fractal
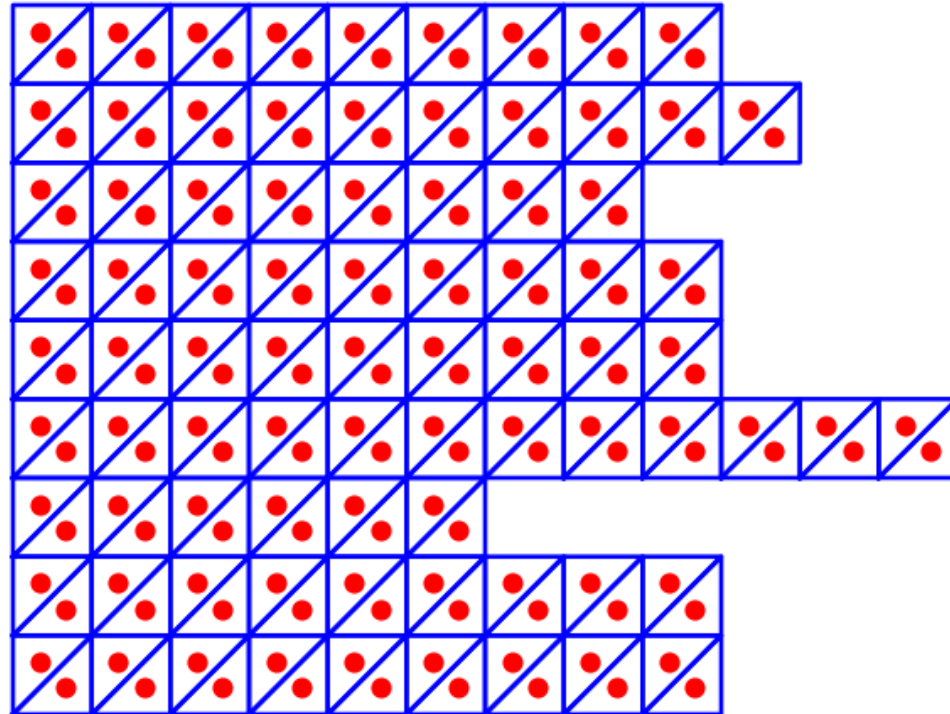Generating peaks and valeys

Part 4 : Visualization

In this section, we will combine all the functions to create a final mesh that may consist of either square or triangular elements, featuring nodes that are not evenly distributed, while also incorporating a comb-like structure
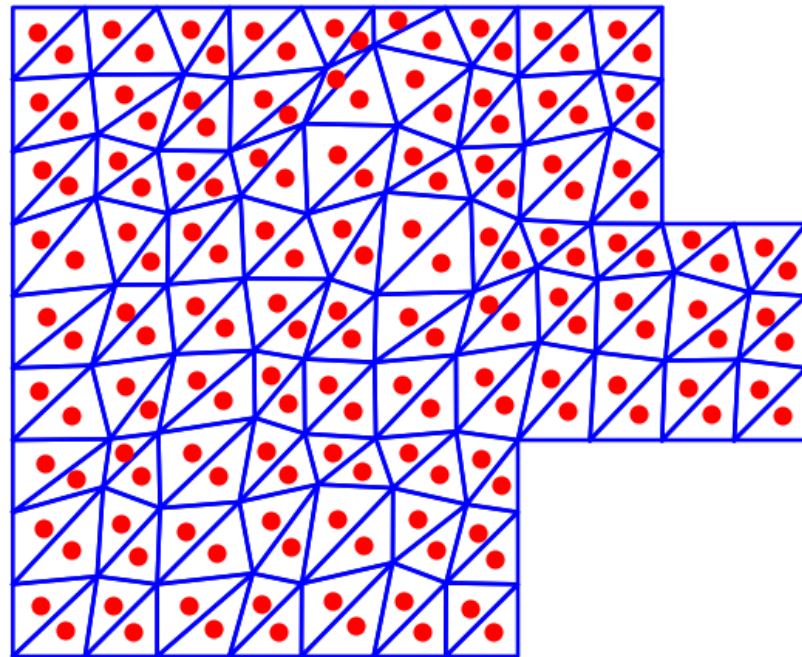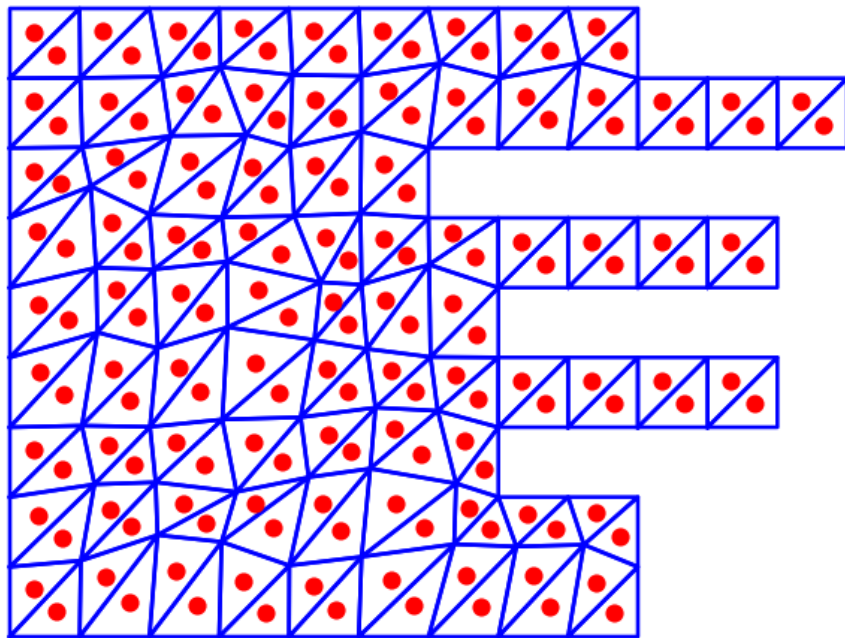
Part 4: Visualization
Computing barycenters

Part 4: Visualization
Final mesh

Conclusion

- Generated a mesh
- Divided the elements into triangles
- Carved according to our needs
- Computed quality factors