Triangle Mesh Optimization
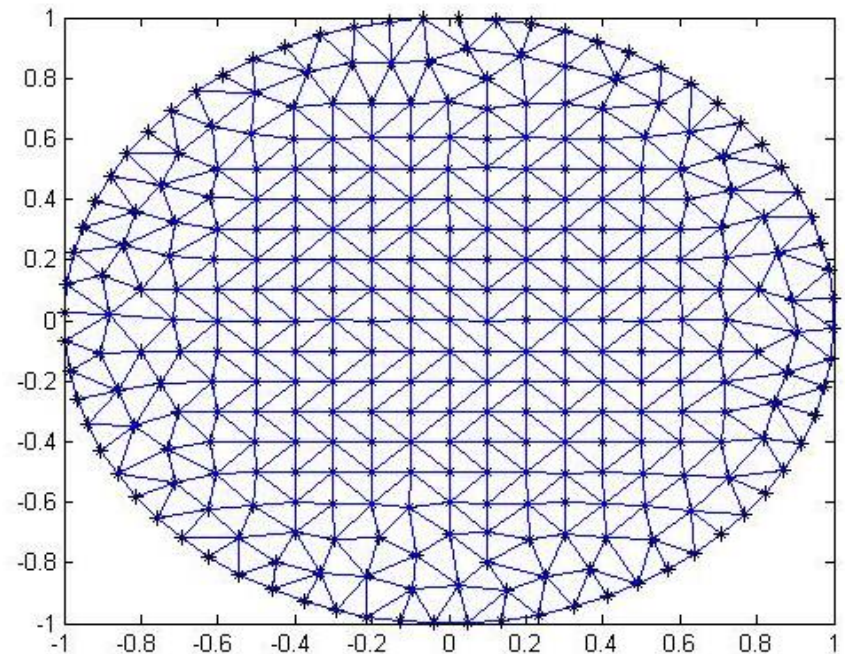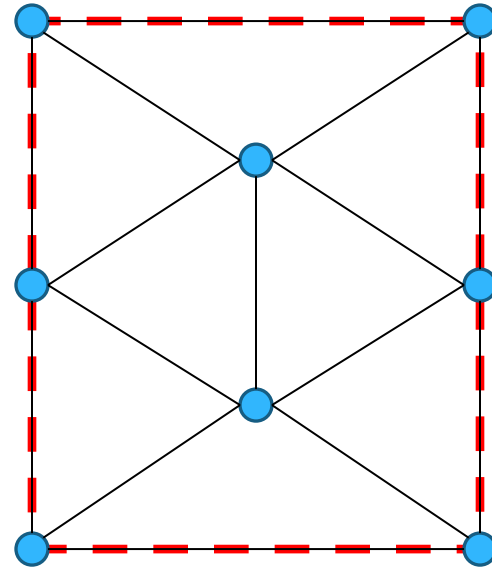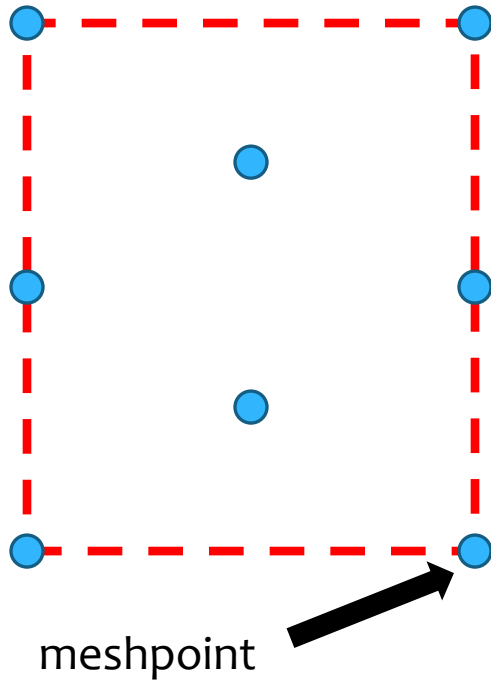
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Mentor: Shawn Walker

Outline

* Background
* Distributing Meshpoints
* Projection Method
* k Nearest Neighbors
* Exterior Domain
* Outer Boundary Force
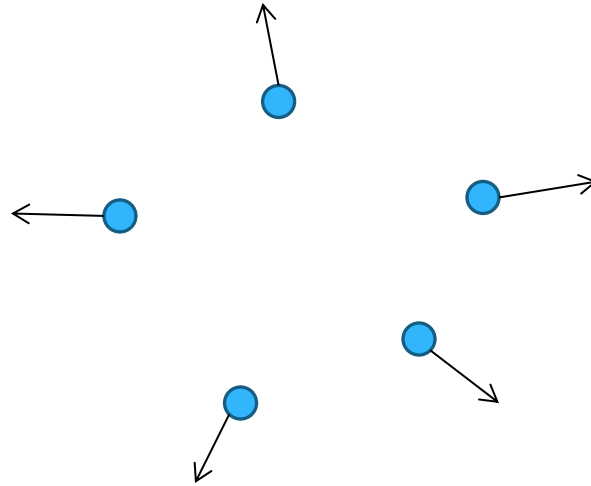* Results
* Conclusion

Background

meshpoint

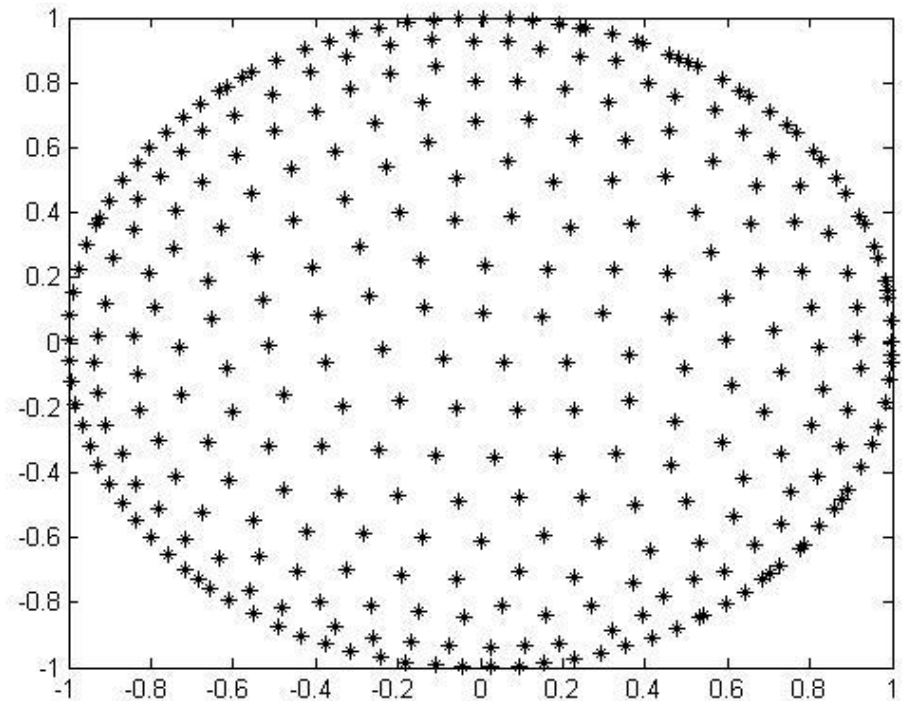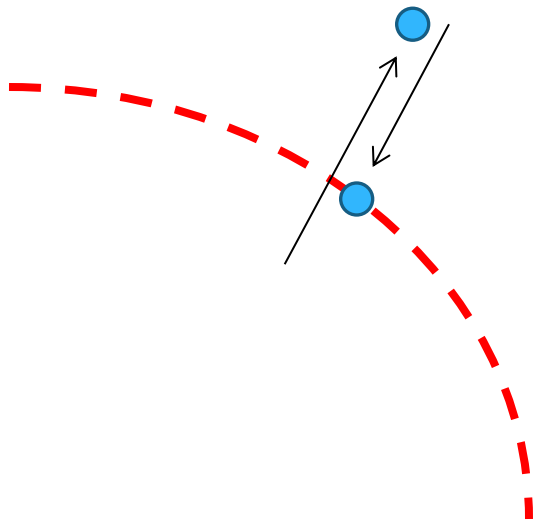Meshes are commonly used in computer graphics and simulations.
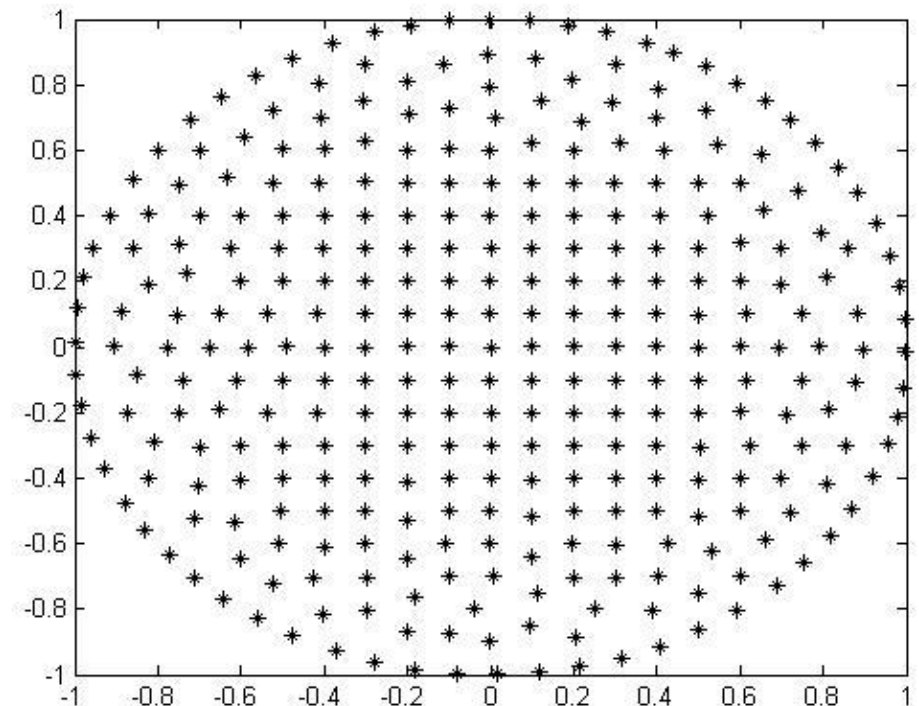
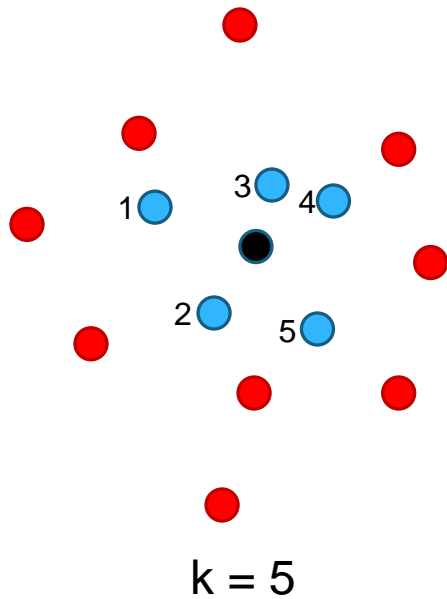# Distributing Meshpoints

Coulomb's Law:
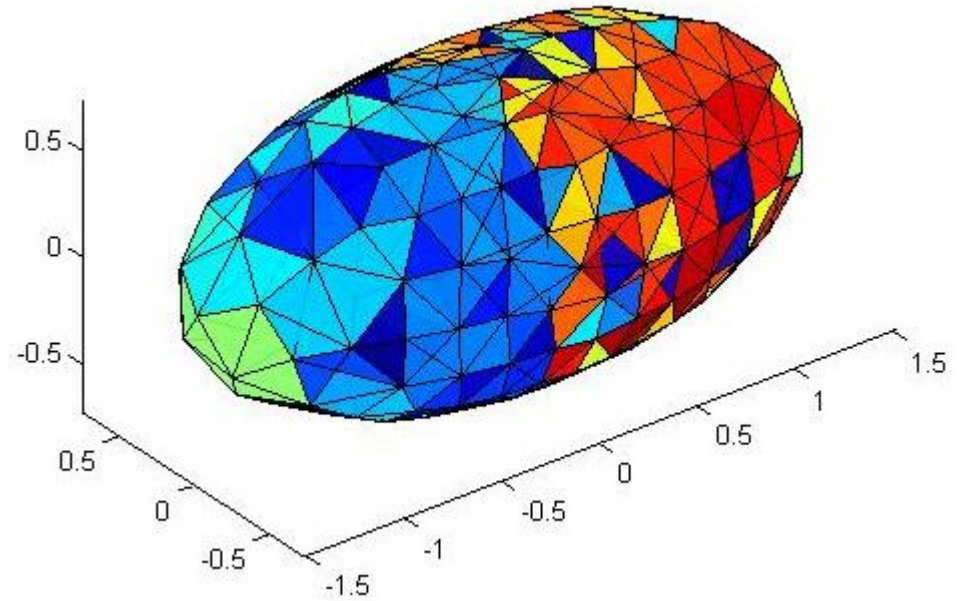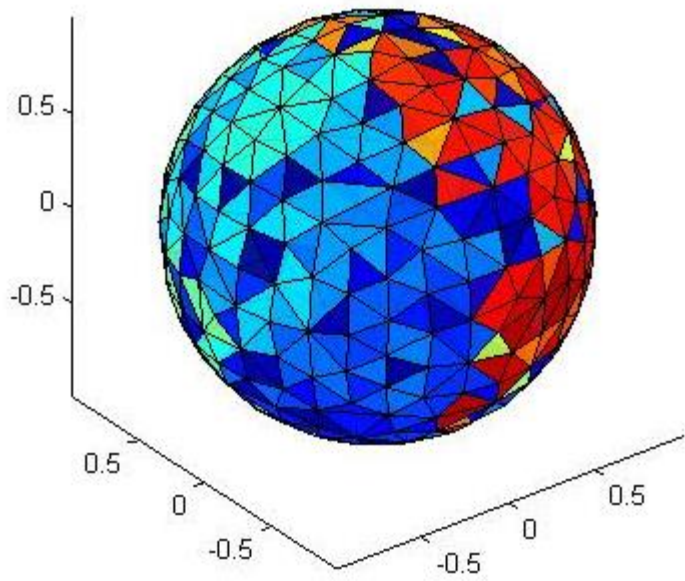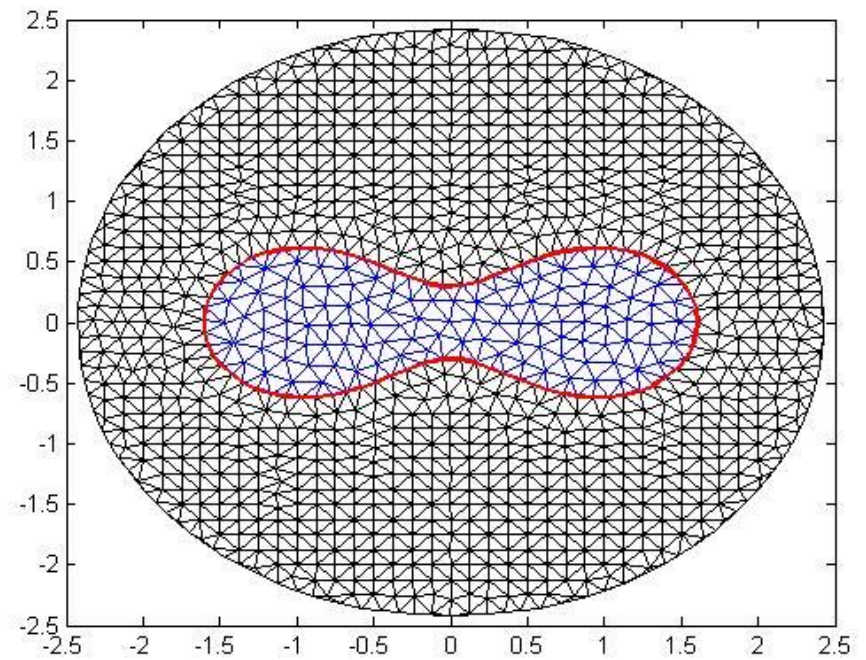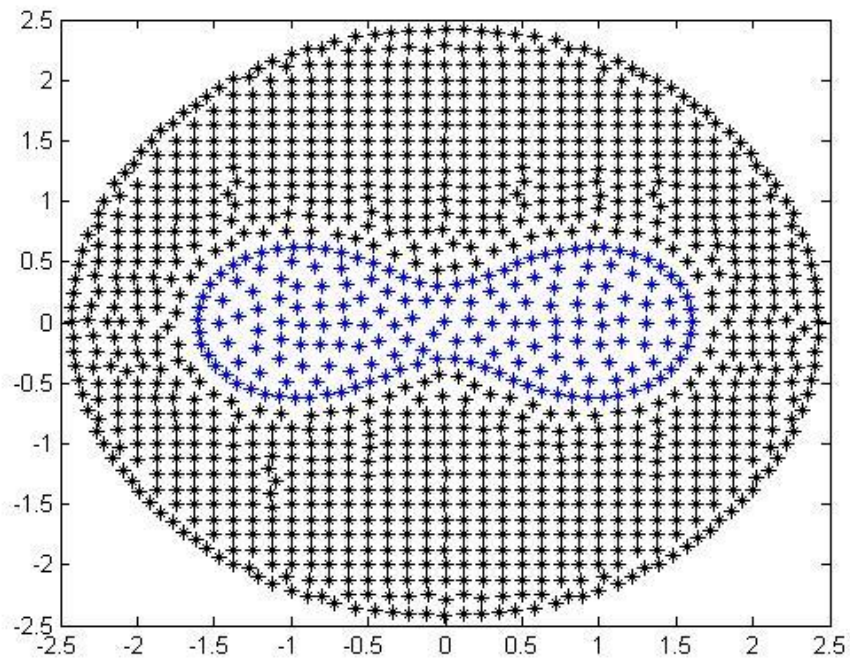$$F(r) = k_e q \sum_{i=1}^{N} q_i \frac{r - r_i}{|r - r_i|^3}$$

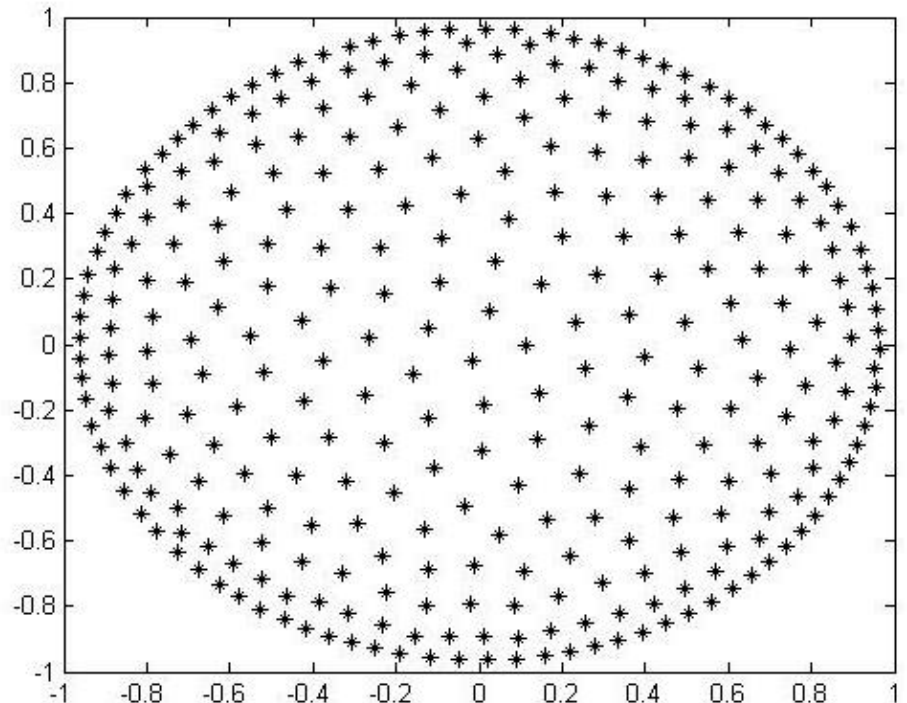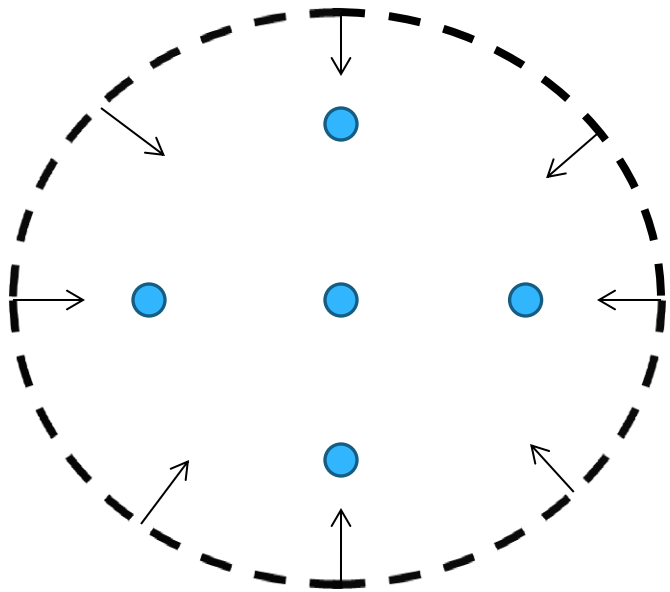# Projection Method

k Nearest Neighbors

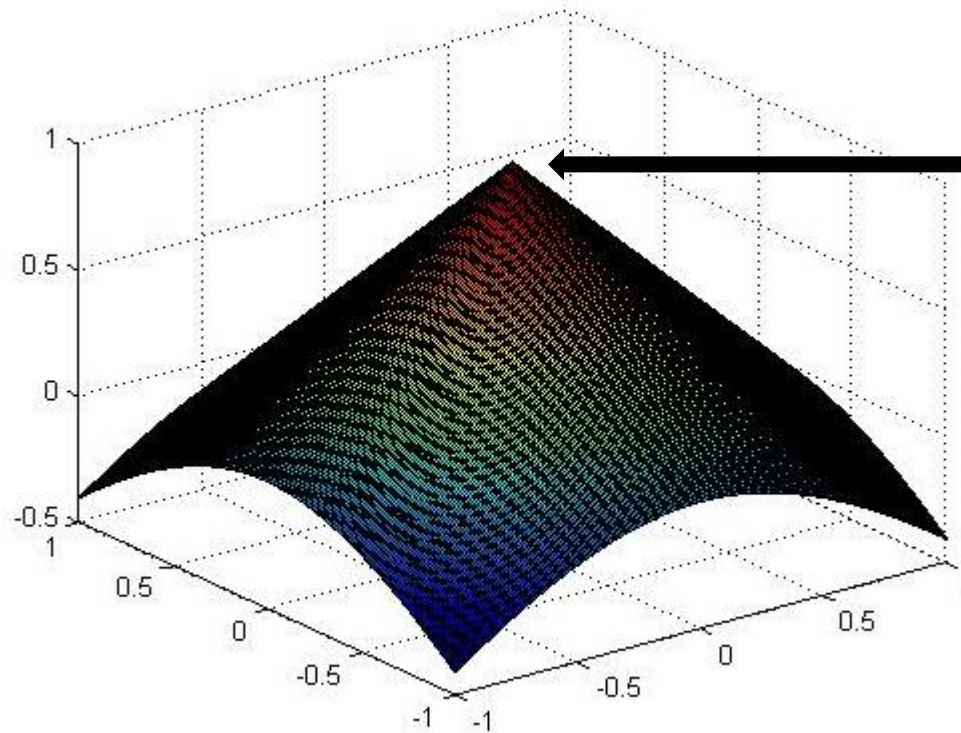k = 5

3-D Case

Exterior Domain

Outer Boundary Force

$$F_b(\phi) = k_e q^2 \frac{\nabla \phi(\phi + 1)}{\phi^2} e^{-\phi}$$

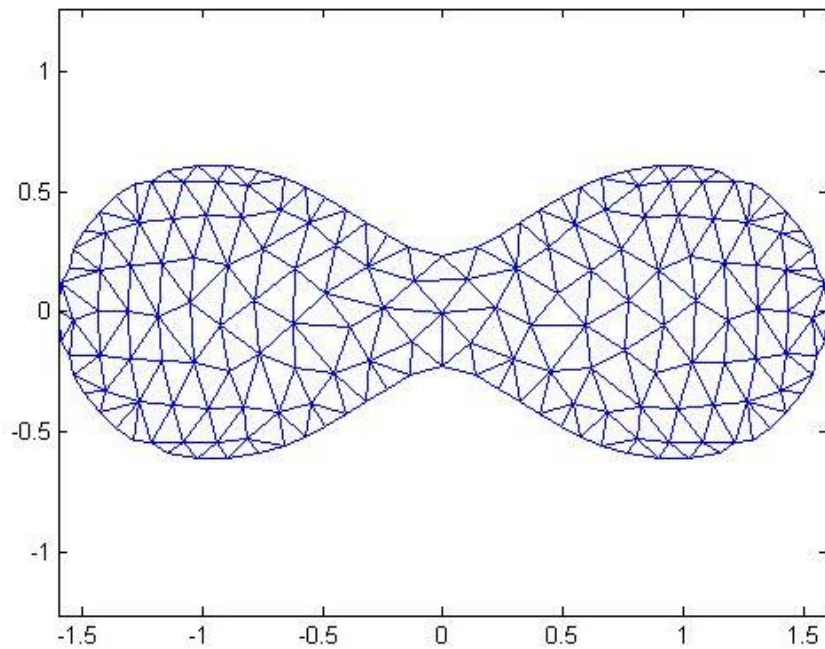# Signed Distance Function

circle: $\phi = C - \sqrt{x^2 + y^2}$
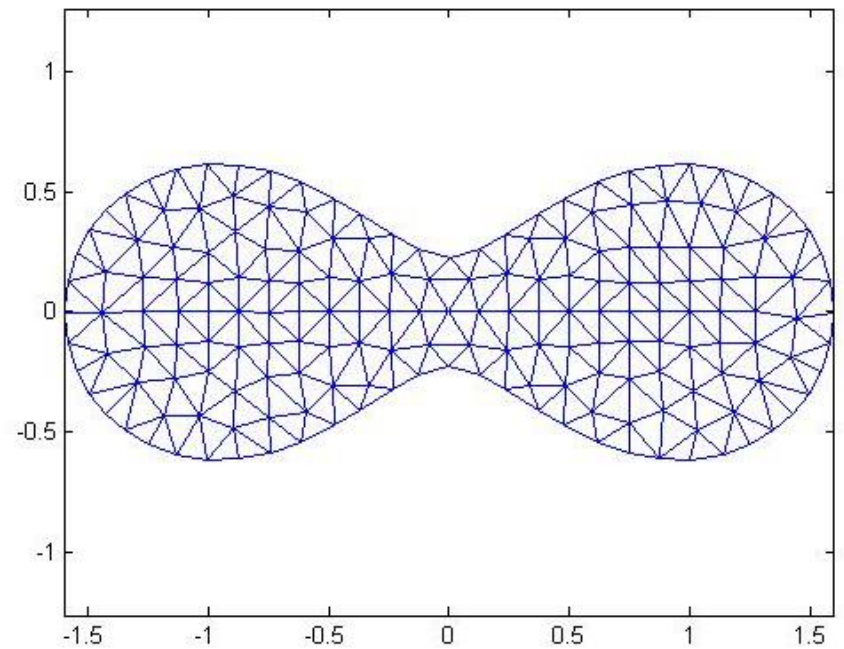

center of circle

C = 1
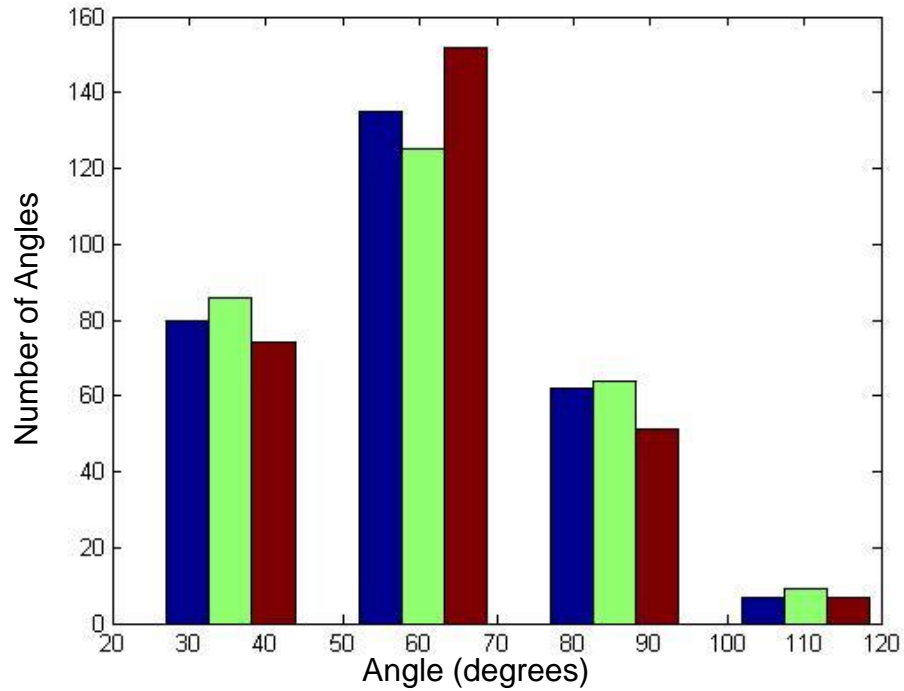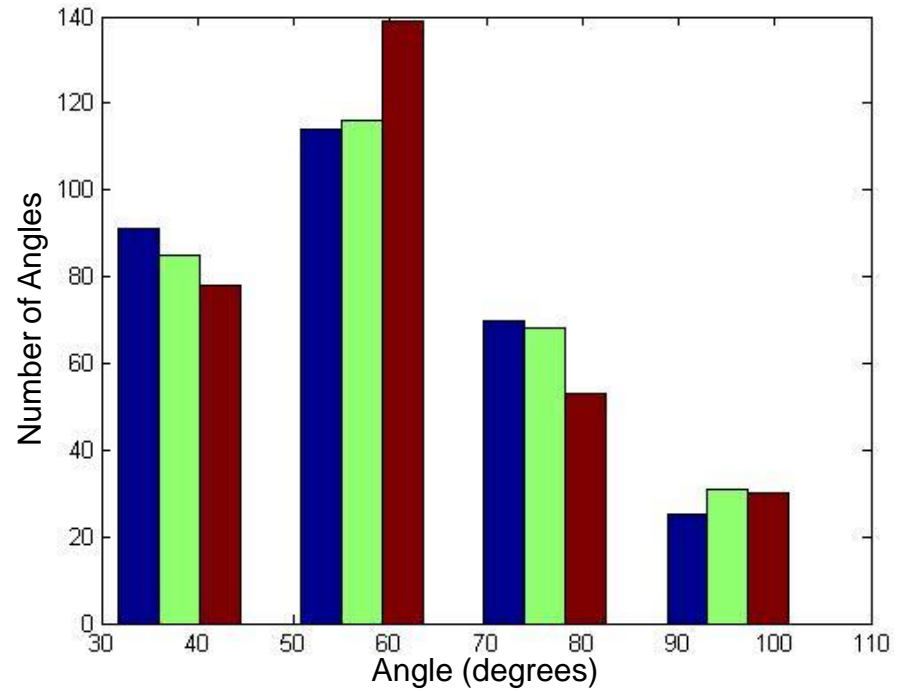
Comparison

All Points

15 Nearest Neighbors

Comparison

All Points

15 Nearest Neighbors

Conclusion

* Meshpoints were distributed across a given domain by giving the points properties that of electric charges.

* Mesh quality was improved through the projection and k nearest neighbors methods.

* Future work includes decreasing computation time (ex: writing C code) and exploring further into using a second domain to improve mesh quality.

Questions?