You can find most of the plots in the link :
https://drive.google.com/drive/folders/1Vyxb0WWsjtslECmtD0RxB5MOGQDwDEj5?usp=share_link

Problem 1:

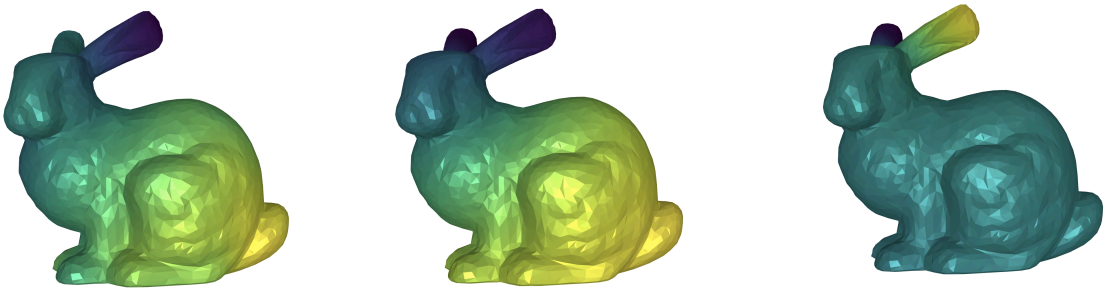
1.DONE- CODE

    1.properties: sparse, symmetric, positive semi definite, sum of each rows go to 0

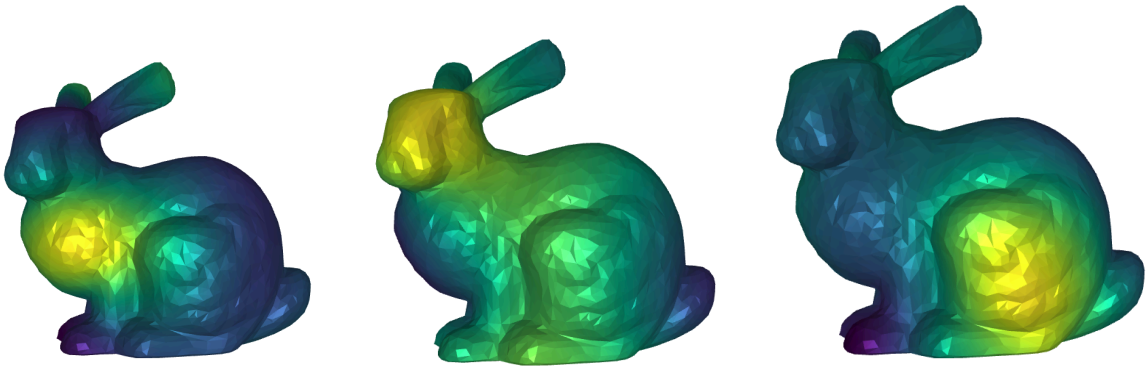
2. DONE-CODE

3.

Bunny smallest eigenvector 0,1,2



Bunny largest eigenvector 1,2,3



Camel_mc smallest eigenvector 0,1,2

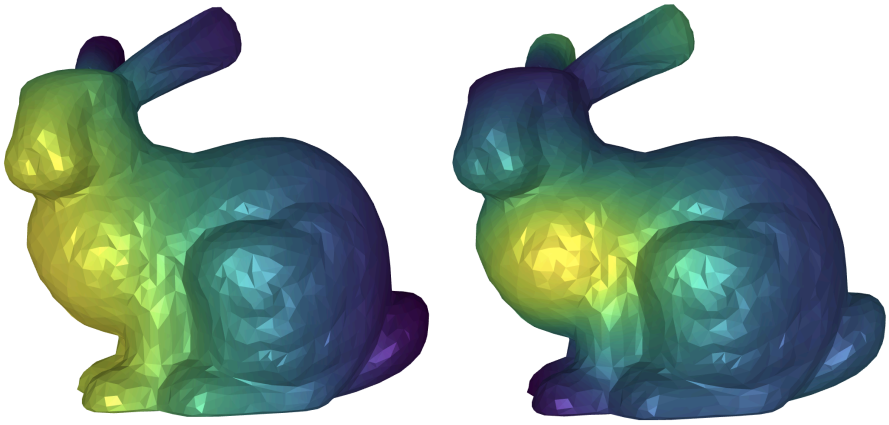
Camel_mc largest eigenvector 1,2,3

Camel-1 smallest eigenvector 0,1,2

Camel-1 largest eigenvector 1,2,3

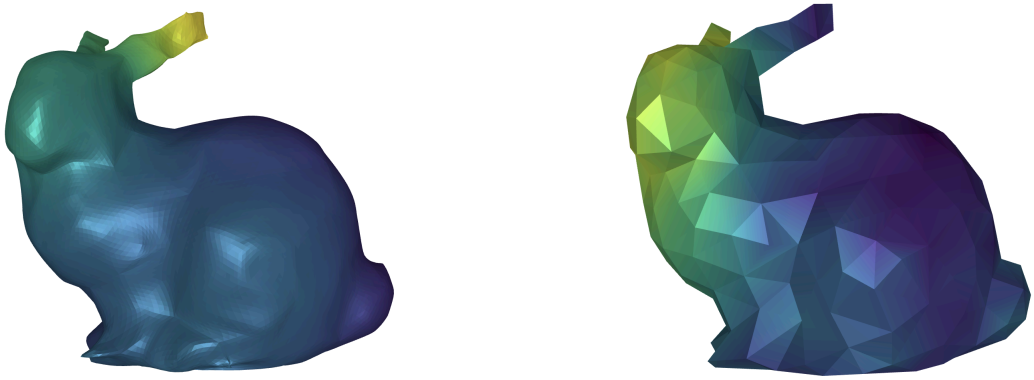
1.The eigenvectors associated with the smallest eigenvalues typically vary smoothly across the mesh.symmetric patterns in these eigenvectors, like the bunny's ears or the camel's back, due to the similar structure of both sides of the object.The eigenvectors associated with larger eigenvalues often have many oscillations or changes in sign, indicating more localized features or details of the mesh.

2. Low frequency - high frequency



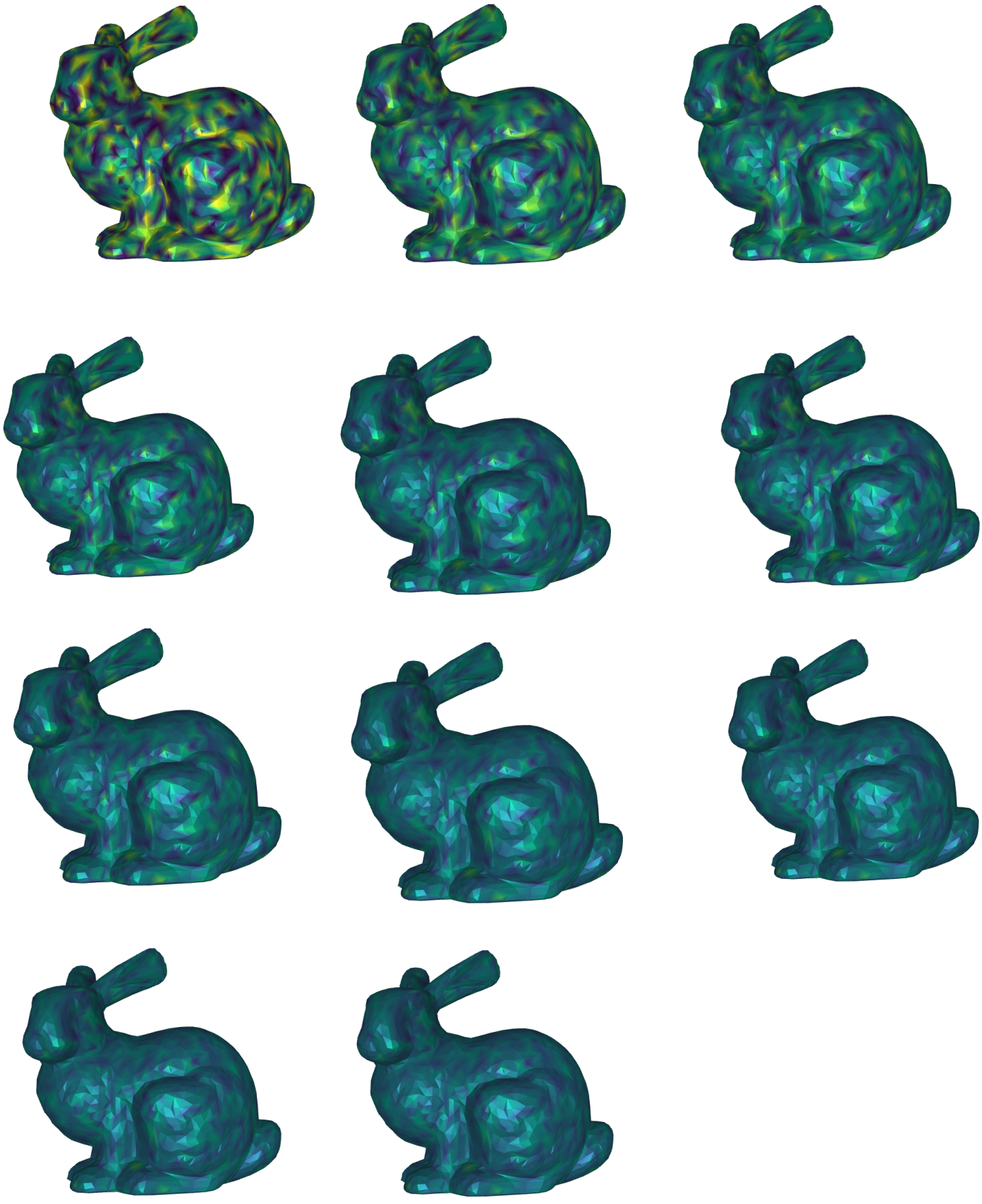
3.Yes, there are similarities between eigenvectors on similar meshes, particularly for low-frequency eigenvectors, they capture the overall shape and symmetries. These similarities suggest the potential for automatic correspondence between shapes. Challenges include sensitivity to noise, differences in local geometry, and different mesh resolutions, which can make it difficult to match high-frequency details accurately.

4. The color gradient is similar but the subdivided one is smoother.
Bunny decimated butterfly subdivision 3.

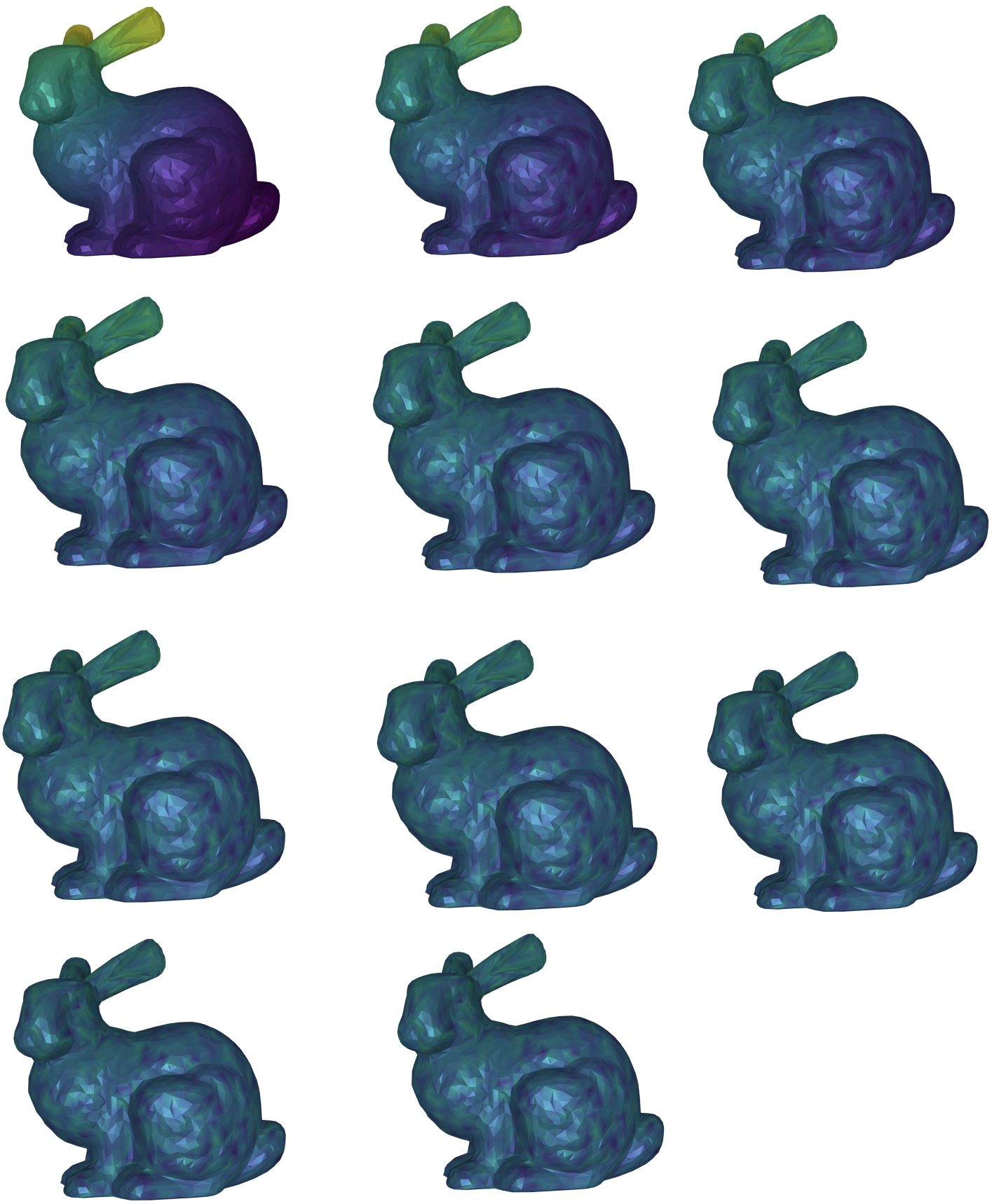


4.Simplest: Barycentric Lumped Mass, spars, symmetric, sum of rows goes to 0

Problem 2:
0.DONE, Galerkin FEM Approach
1.

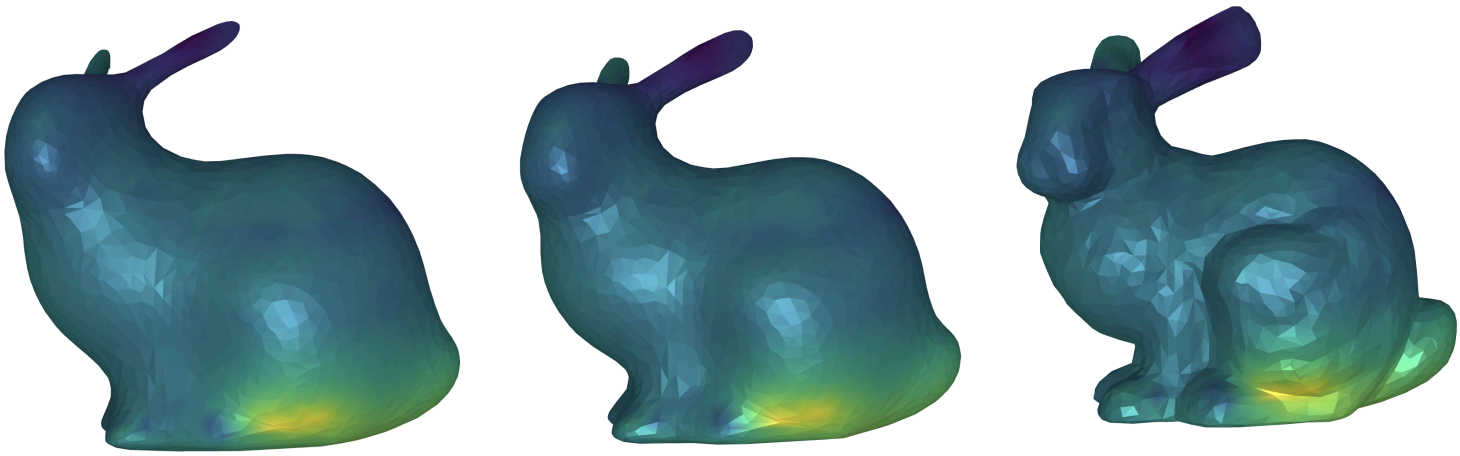


2.



Problem3:

1. The shape is getting smoother and details are dissolving.



2. I changed the mass matrix as described in the paper but couldn't solve the singularity problem.