

Math 77A Project 4 (Due March 7)

Instructions: This project will require some MATLAB code. Please submit your solution as an `.m` file. When turning in the project, name your file `project4_yourlastname.m` and email it to `eesser@uci.edu`. If you are submitting multiple files, please zip them together in a file named `project4_yourlastname.zip`.

1. Construct several low rank approximations to a color image of your choosing. After reading the original image into MATLAB as an M by N by 3 matrix, construct a $3M$ by N matrix by stacking the red, green and blue components. Then use the singular value decomposition to compute three low rank approximations to this matrix of rank 10, 50 and 100. Compare the reconstructed color images to the original.

2. Suppose we have a highly nonlinear spring for which the force F as a function of displacement x is modeled by $F(x) = k_1x + k_3x^3 + k_{13}x^{13}$. We want to estimate the coefficients k_1 , k_3 and k_{13} from the measurements of F at different displacements shown in

the following table.

x	F
1	-11.11
1.01	-11.24
1.02	-11.39
1.03	-11.54
10	-10^{12}

Set up a least squares problem to estimate the coefficients from these measurements. Solve for the 'best fit' coefficients using three different techniques:

- Directly solve the normal equations
- Use the QR factorization
- Use the singular value decomposition

Do the solutions agree? Which estimates are more reliable?