NumComp - Fall 2022
Project #4

Due –

Numerical Computing :: Project Four

I've posted five different matrices as comma-separated text files. For each matrix, first load the matrix into memory. Then answer the following questions for each matrix:

1. What are the matrix dimensions?
2. How many nonzeros are there?
3. Is it symmetric?
4. Is it diagonal?
5. Is it orthogonal?
6. What is the rank?
7. What is the smallest singular value?
8. What is the largest singular value?
9. What is the condition number?
10. Generate five random right-hand-sides. For each right-hand-side b, try to solve $Ax = b$ with the appropriate solver (like `linsolve`). Did the solver have any issues solving the systems?

For each matrix, make two plots:

1. Plot the nonzero elements of the matrix.
2. Plot the magnitude of the elements of the matrix.

If you don't like the matrices I've posted, use your own from your work. Here are three great places to find interesting matrices:

- Tim Davis's SuiteSparse Matrix Collection
- NIST Matrix Market
- Matlab's `gallery`

If you use these, tell me why you think the matrix is interesting.

- Matrix Dimensions

$M_1 : 10\times10 \quad M_2 : 30\times30 \quad M_3 : 400\times400 \quad M_4 : 50\times50 \quad M_5 : 625\times625$

- Nonzeros

$M_1 : 45 \quad M_2 : 0 \quad M_3 : 159200 \quad M_4 : 0 \quad M_5 : 387600$

- Symmetric

$M_1 : No \quad M_2 : Yes \quad M_3 : No \quad M_4 : No \quad M_5 : Yes$

- Diagonal

$M_1 : No \quad M_2 : No \quad M_3 : No \quad M_4 : No \quad M_5 : No$

- Orthogonal

$M_1 : No \quad M_2 : No \quad M_3 : No \quad M_4 : No \quad M_5 : No$

- Rank

$M_1 : 10 \quad M_2 : 30 \quad M_3 : 399 \quad M_4 : 50 \quad M_5 : 625$

- Smallest Value

$M_1 : -.9808 \quad M_2 : -5.0437 \quad M_3 : -1 \quad M_4 : -0.4116 \quad M_5 : -1$

- Largest Value

$M_1 : 1 \quad M_2 : 12.6332 \quad M_3 : 1 \quad M_4 : 1 \quad M_5 : 4$

- Condition Number

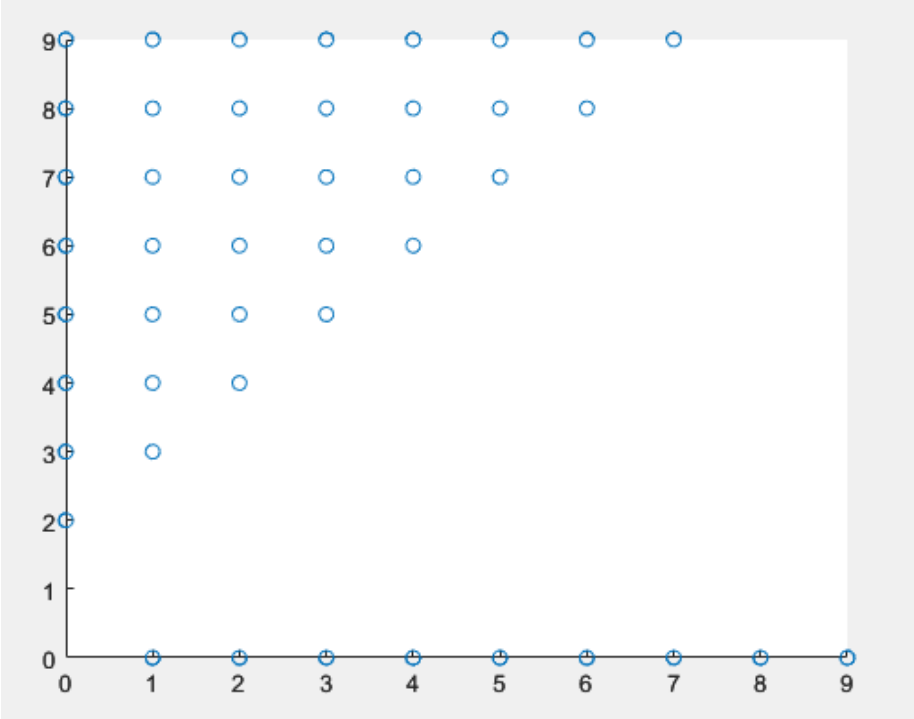
  $M_1 : 124.3998$ $M_2 : 206.6727$ $M_3 : 4.3293e{+}16$ $M_4 : 1.0000$ $M_5 : 273.306$

- Solve the Systems

  $M_1 : Noissue$ $M_2 : Noissue$ $M_3 : Errorforlinsolve, pcgworked$ $M_4 : Nois$

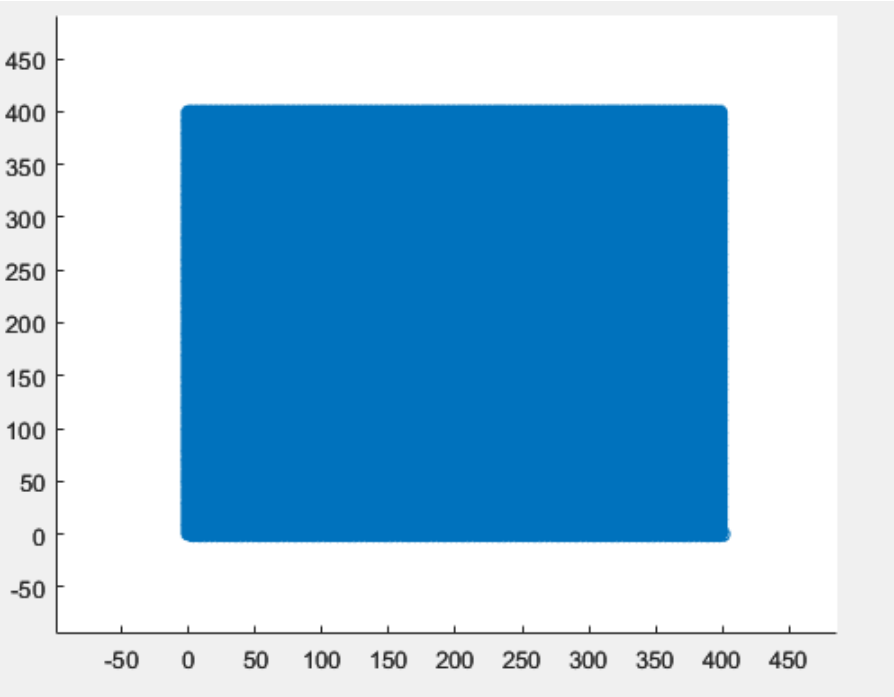
- Plot Non zeros (technically i plotted the zeros but the data displayed is the same)

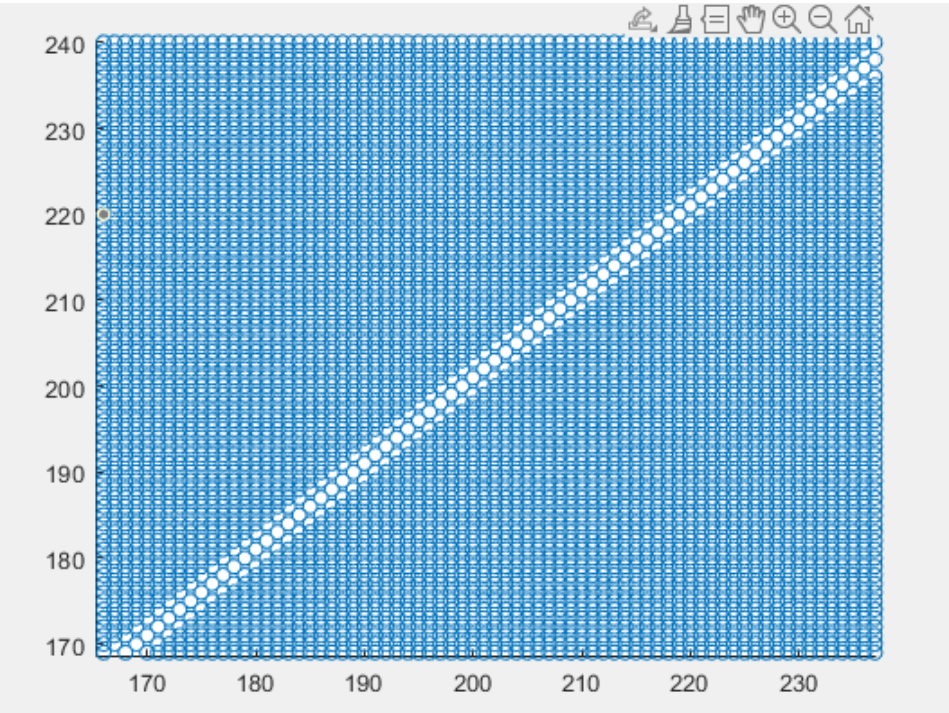
  M1



M2 has all zeros

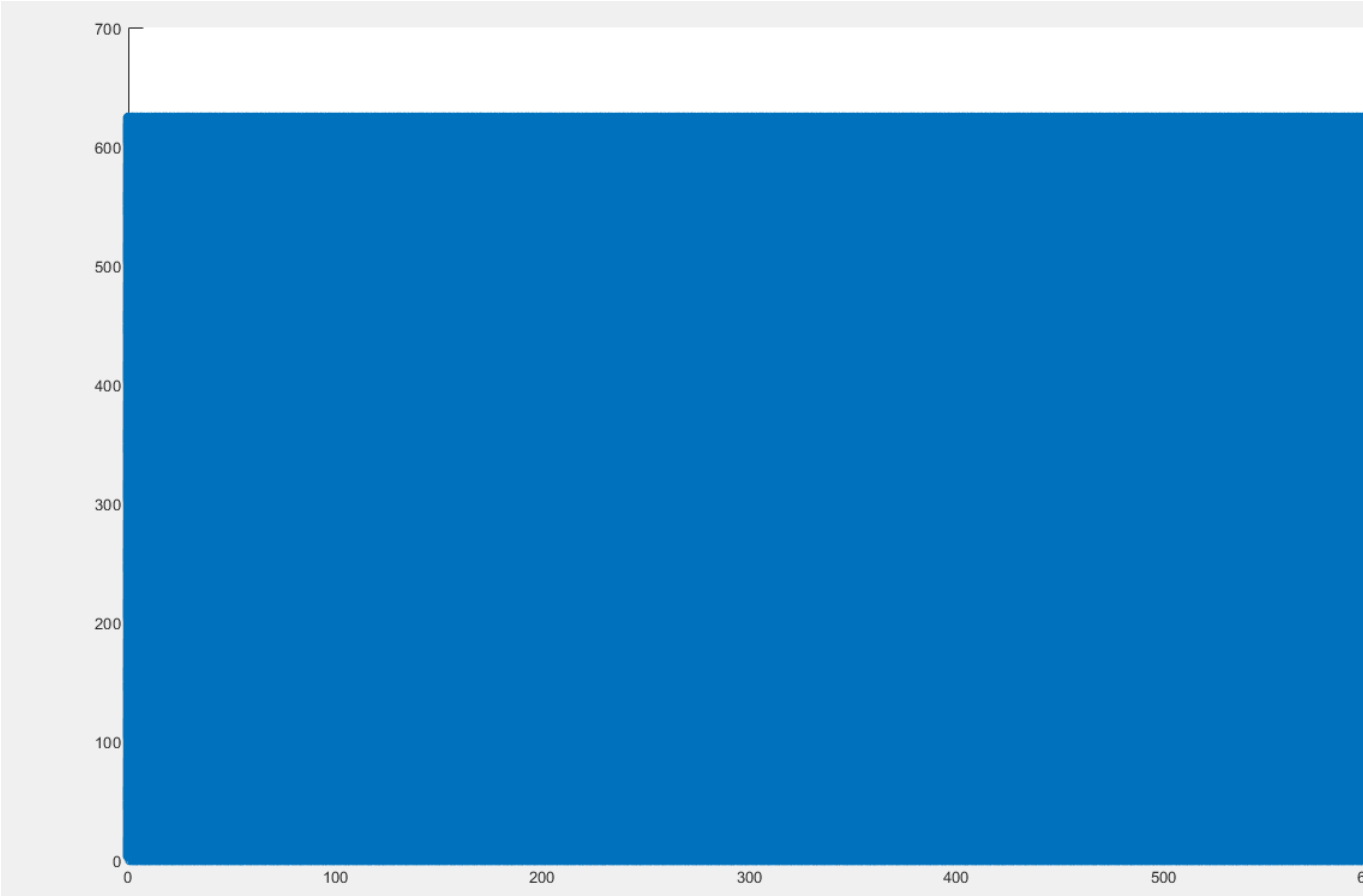
M3

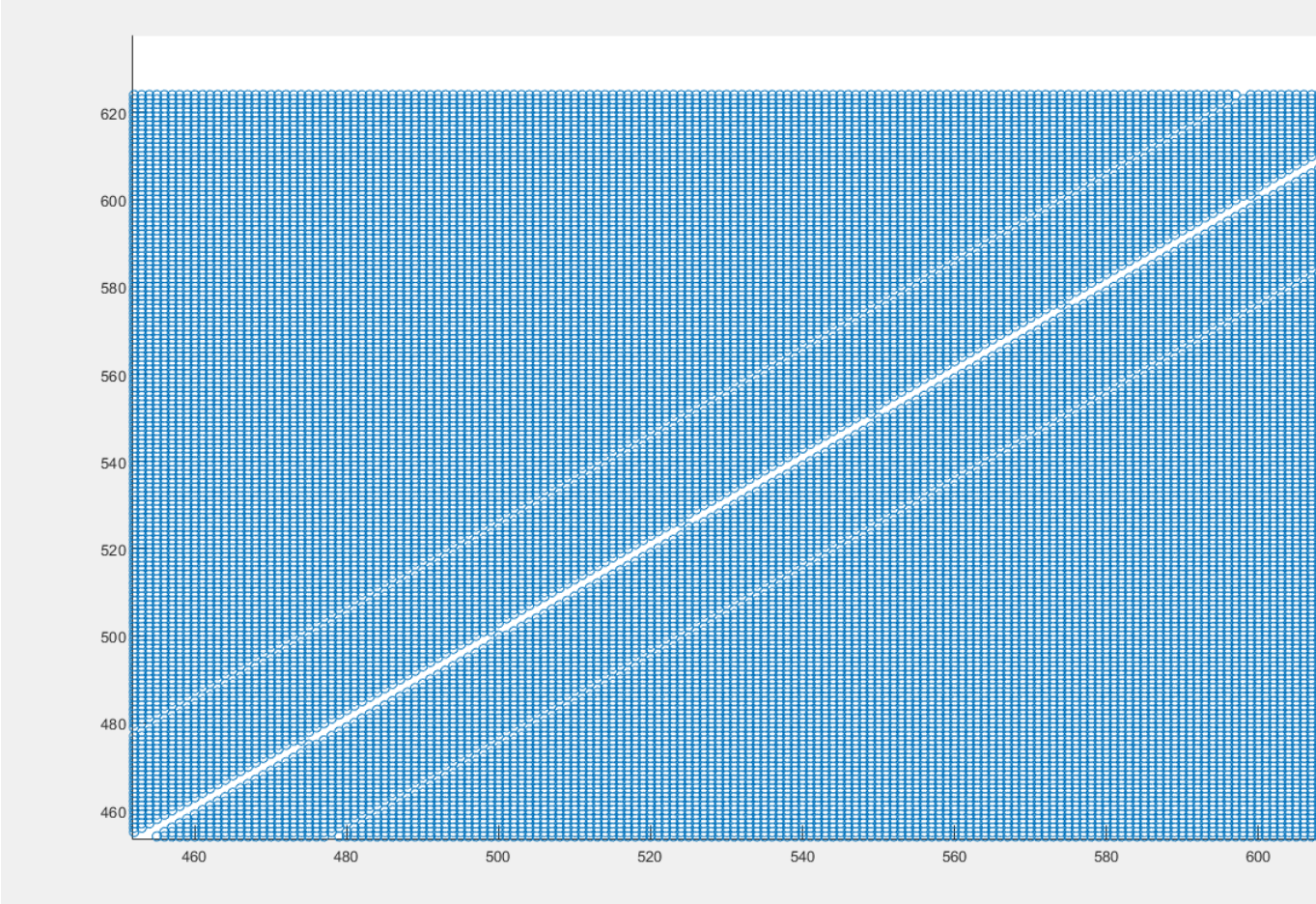

450
400
350
300
250
200
150
100
50
0
-50
-50 0 50 100 150 200 250 300 350 400 450


240
230
220
210
200
190
180
170
170 180 190 200 210 220 230

M4 has all zeros

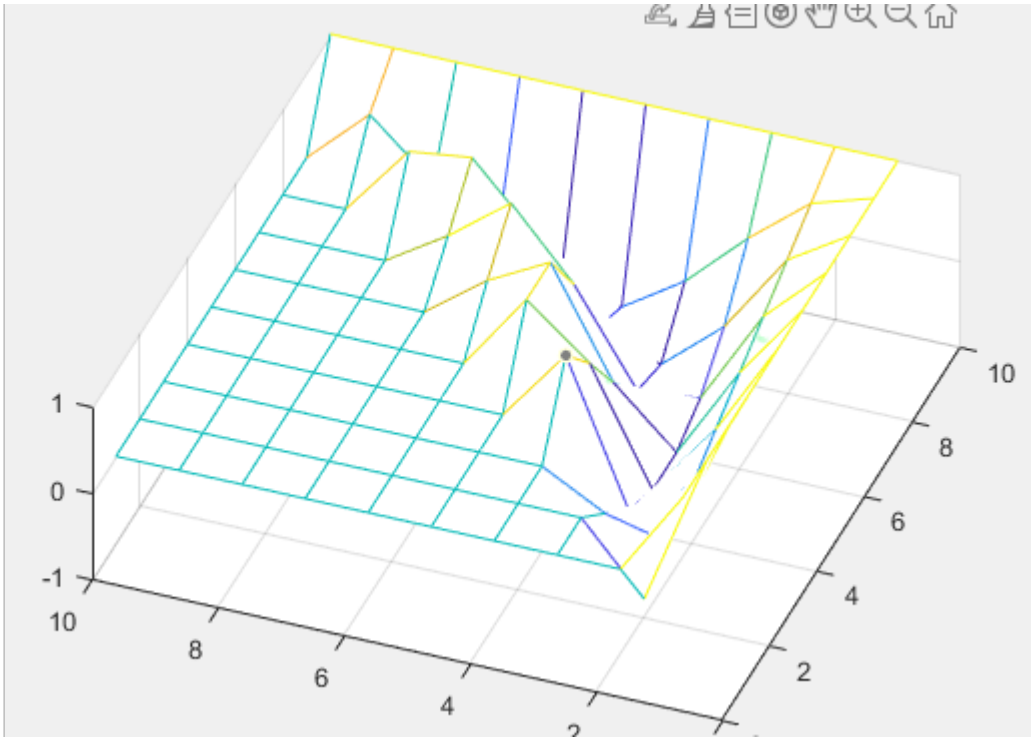
M5



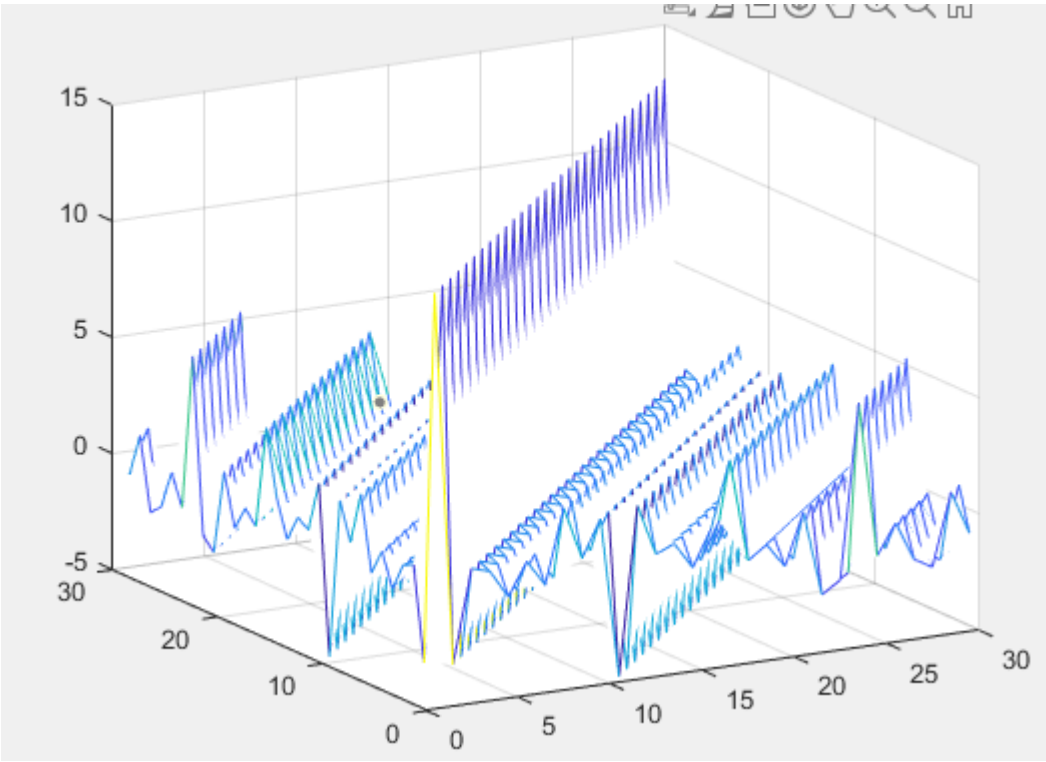

620
600
580
560
540
520
500
480
460
460
480
500
520
540
560
580
600

- Plot magnitude of matrices

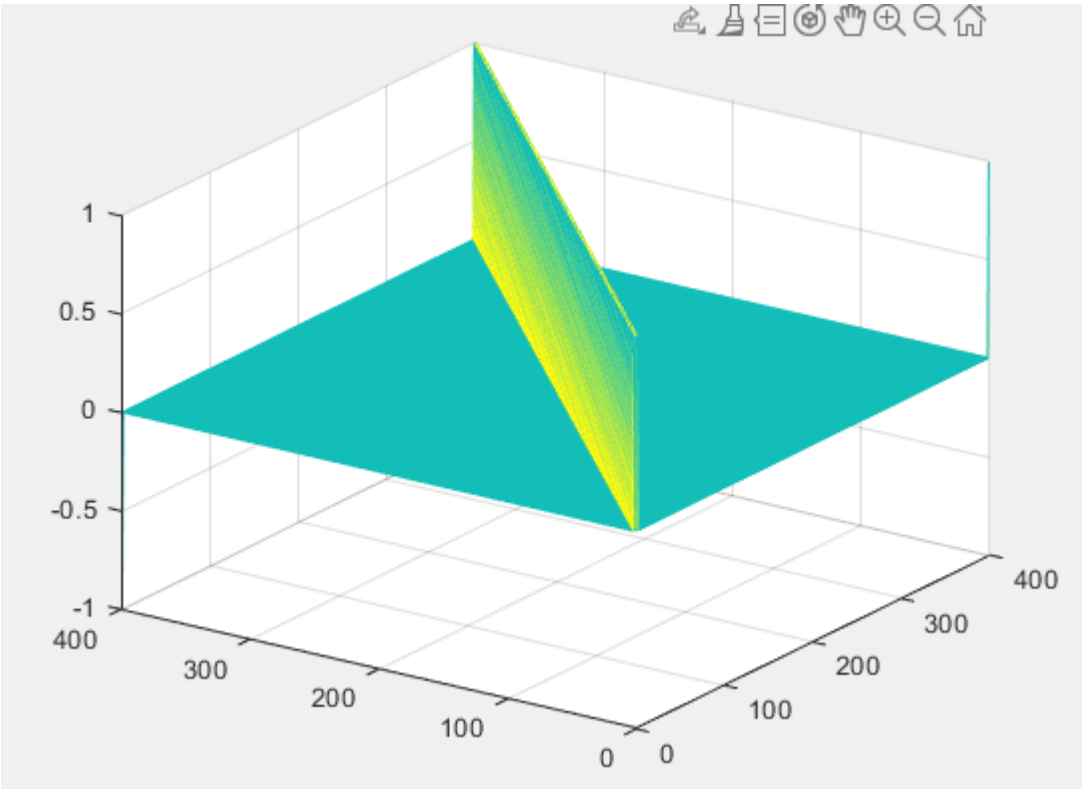
  M1



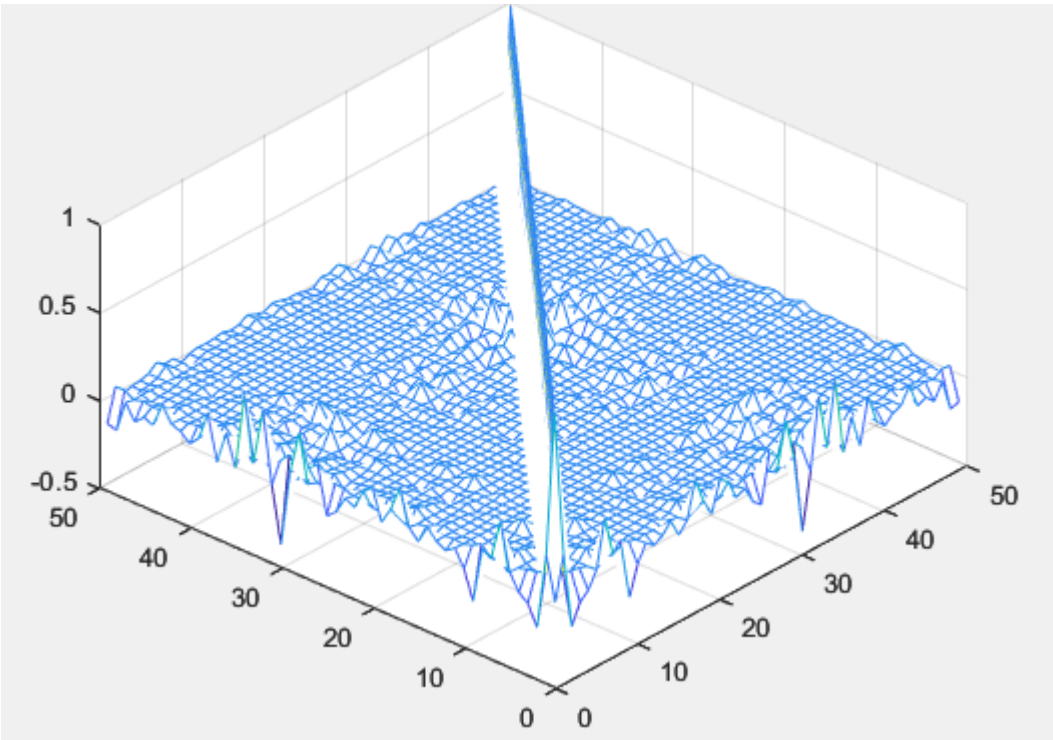
M2



M3



M4



M5