MATHEMATICS FOR ENGINEERS

MATLAB TOPICS

(1) Plot a given function or functions on a given interval.
(2) Writing a for loop e.g. plotting nth roots of unity, sum of the first n natural numbers, etc.
(3) Writing a function.
(4) Defining matrices, vectors, operations with matrices and vectors.
(5) "Dotted" arithmetic operations.
(6) Linear dependency and independency.
(7) Rank, inverse and determinant of matrices.
(8) Solving linear system of equations.
(9) Calculation of eigenvalues and eigenvectors.
(10) Solving least square problem, and plotting the data and the model function in one figure.
(11) Lagrange interpolation, and plotting the data and the polynomial in one figure.
(12) Spline interpolation.
(13) Numerical integration.

First sample

(1) Let A be a 4×4 Hilbert matrix. Define an arbitrary b, and solve the linear system $Ax = b$. Calculate the condition number, the inverse, the rank and the determinant of A.

(2) Plot the hundredth roots of unity!

(3) Give the parameter of the model function $F(t) = x_1 + x_2\cos(\pi t) + x_3\sin(\pi t)$ which fits the best in least square sense to the following data!

t_i	0.1	0.5	1.2	1.5	2	2.1	2.4	3	3.2
f_i	3.9	2.6	-0.8	0.3	3.2	3.8	3.2	-0.7	-0.9

Plot the data and the model on a same figure!

Second sample

(1) Define the functions $f(x) = \frac{1}{\sqrt{1+2x^2}}$, $g(x) = x\sin(x^2)$ with the `function` command! Plot them over the interval $[-2, 2]$ on the same figure!

(2) Calculate the eigenvalues and eigenvectors of the following matrix!

$$\begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

(3) Determine the minimal degree polynomial which interpolates the following data!

x_i	1	1.5	2	2.5	3	3.5	4	4.5	5
f_i	0	1	0	-1	1	3.2	3.2	-0.1	-0.1