MATLAB assignment 3

Introduction to Linear Algebra (Week 3) **Fall, 2019**

1. (*3D Graphics in* MATLAB)

   (a) Referring to the followings, draw a graph of helix curve given by the vector equation

   $$\mathbf{c}(t) = (t\cos(20\pi t),\ t\sin(20\pi t),\ \tanh t)\,,$$

   where the parameter t varies from -1 to 1.

   i. Construct a vector `t` which consist of equally-spaced points in $[-1,\ 1]$.
   [If you do not know what to do, go back to 'week2'.]

   ii. Use the MATLAB built-in command `plot3` to plot the curve in 3D space.

   (b) Referring to the followings, plot the surface(or mesh graph) of the graph given by

   $$z = xe^{-x^2-y^2},$$

   over the region in the xy-plane defined by $\mathcal{D} = \{(x, y) : -2 \le x \le 2, -2 \le y \le 2\}$.

   i. Using the MATLAB built-in command `meshgrid`, construct two matrices, each of which consist of the x coordinates and y coordinates of the $\mathcal{D}$, respectively.

   ii. Using the MATLAB built-in commands `surf` or `mesh`, create a 3D surface plot.

Submission guide

- Download the guide code(`assignment3_1a.m`) in the KLMS and fill out missing parts to plot a 3D graph of the curve given by (a).
- Download the guide code(`assignment3_1b.m`) in the KLMS and fill out missing parts to plot a graph of the surface given by (b).
- Upload the completed code files, `assignment3_1a.m` and `assignment3_1b.m`, to 'Homework box for MATLAB assignment 3' in the KLMS

Due date : Oct 04 (Fri) 10:55 a.m.
Late submission will not be allowed.

2. (*Supplement problem*)

   (a) Plot the graph of the curve $\mathbf{M}(t)$ given by the parametric equations,

   $$\mathbf{M}(t) = (x(t),\, y(t),\, z(t))\,, \qquad t \in [-1,\, 1]$$

   where the $x(t)$, $y(t)$, $z(t)$ are defined as

   $$\begin{aligned} x(t) &= R\cos\phi + r\cos\theta\cos\eta, \\ y(t) &= R\sin\phi + r\sin\theta, \\ z(t) &= r\cos\theta\sin\eta, \end{aligned}$$

   with **appropriate values** R, r, η and functions $\phi(t) = 2\pi t$, $\theta(t) = 2\pi tp$ with **appropriate** p. (You can choose R, r, η, p by your self)

   [Note that if you choose the values such as $R \approx 1.5 \times 10^9$, $r \approx 4 \times 10^5$, $\eta = 5.14^\circ$ and $p \approx 365.24$, then the curve represents the orbit of the Moon around the Earth.]

3. Read the attachment "MATLAB_Week3.pdf" and practice by yourself.