Homework 1: ME5701, 13 August 2020

1. Show that for any given complex numbers c_1 and c_2,

$$\overline{c_1 c_2} = \overline{c}_1 \, \overline{c}_2$$

2. Show that for any three matrices A, B, C such that the matrix products AB and BC make sense, that

$$A(BC) = (AB)C$$

3. Define $A^{-T} \doteq (A^{-1})^T$. Show: a) $A^{-T} = (A^T)^{-1}$; b) Write $(AB)^{-T}$ in terms of A^{-T} and B^{-T}.

4. Prove that convolution of and two L-periodic functions is commutative. That is, $(f_1 * f_2)(x) = (f_2 * f_1)(x)$.

5. Let $L = 2\pi$ and consider the 2π-periodic saw-tooth function defined by the piecewise linear functions connecting the points $(0, 0)$ and (π, h) with a line segment and the points (π, h) and $(2\pi, 0)$ with a line segment. Compute its Fourier series approximation where the infinite summation is truncated to $k \in [-B, B]$, and plot using Matlab for $B = 1, 2, 5, 10$.

6. Write the equations of motion for the double pendulum using free-body diagrams (using Newton's Laws), and compare with the presented answers derived from Lagrange's equations. (The exercise is for you to attempt on your own, not to find on the internet or in a book. Doing that would be a violation of honor code).