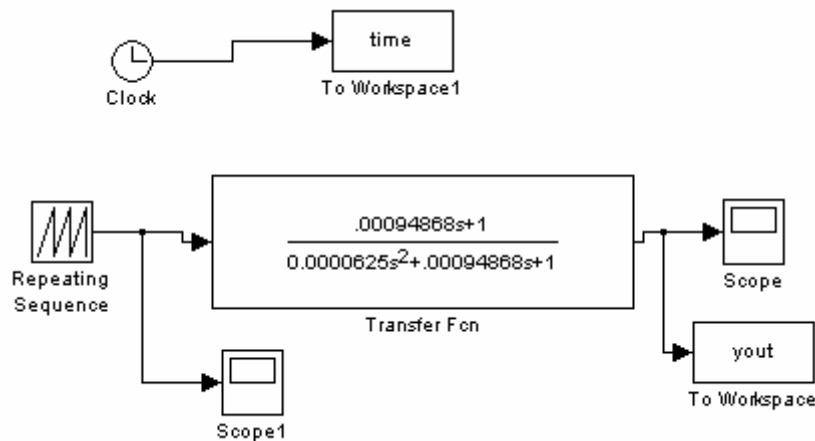


Homework- Lecture 14

Problem 14.1

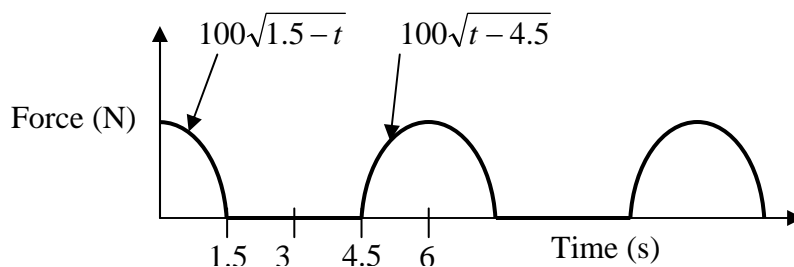
The base of a spring mass system is subjected to the periodic displacement shown in Figure 4.32 in Rao.

- Determine the steady state response of the mass assuming $m = 0.5$ kg, $k = 8000$ N/m, $\zeta = 0.06$, $Y = 5$ mm and $\tau = 0.4$ s.
- How many terms do you need to keep in your Fourier Series?
- Solve this problem using Simulink and compare your solutions. Assume zero initial conditions so if you'd like to use a transfer function block (it is located in the "continuous" block set – all you have to do is input the numerator and denominator polynomials) that would be fine. Be sure to include a snapshot of your Simulink model and a plot of your output. It should look something like the figure below.



Problem 14.2

A standard second order system ($m = 0.25$ kg, $k = 1000$ N/m, $c = 0.3$ N-s/m) is forced with a periodic force as shown below (only the portion of the force for $t > 0$ is shown and the equations are only valid for the cycle between $0 < t < 6$). The force is zero between 1.5 and 4.5 s.



Determine

- the Fourier series for the input force (write down the first 3 non-zero terms below)
- the steady state response of the system (write down the first 3 non-zero terms below).
- about how many terms do you need in your steady state solution to have a good approximation? (Run your simulation for various numbers of terms to answer this question – make sure you are past resonance.)

For both these problems clearly show what you need to put in your Maple worksheets and include a printout of your Maple worksheet.