Part A (65%): In-Class Exam.

1. (10%) Solve $y'' - 4y' + 4y = (x + 1)e^{2x}$.

2. (10%) Find a general solution to $y''' + 3y'' - y' - 3y = 0$.

3. (10%) Find a particular solution to $y'' + 4y = 5t^2 e^t$.

4. (15%) Solve the initial-value problem $y'' + y = 4x + 10 \sin x$, $y(\pi) = 0$, $y'(\pi) = 2$.

5. (20%) Find power series solution of $y'' - x y = 0$ near $x=0$.

Part B (35%): Take Home Exam. Due on Nov. 14 13PM. Upload your file to the course web in eeclass.

6. (13%) Consider the differential equation: $mu'' + \gamma u' + ku = F_0 \cos(\omega t)$. Use Matlab to plot the amplitude of steady-state response versus frequency of driving force for several values of the dimensionless damping parameter $\Gamma = \gamma^2/mk$ as shown in Fig. 1.
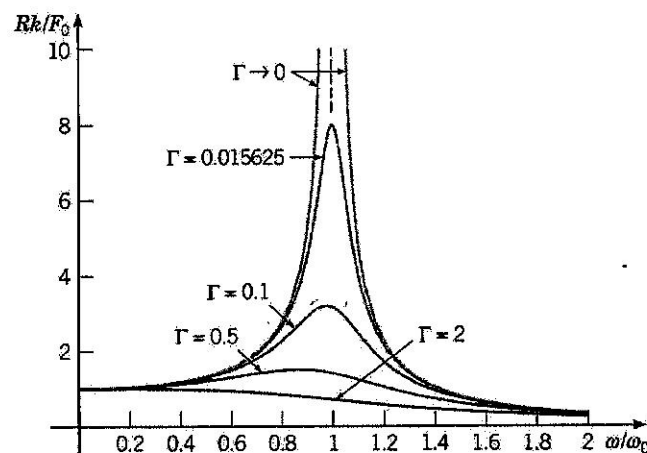

Fig. 1

7. (9%) Use Matlab, plot the exact solution of $u'' + u = F(t)$, where $F(t) = 0.5\cos(0.8t)$, $u(0) = 0$, $u'(0) = 0$ and the external force $F(t)$ for $t=0$ to 70 in the same figure. Discuss their time domain behavior between the external force and the solution if the initial condition are varied.

8. (13%) Use Matlab, plot several partial sums in a series solution of the initial-value problem $y'' + xy' + 2y = 0$, $y(0) = 0$, $y'(0) = 1$ about $x = 0$ for $n=0, 1, \ldots 7$ in the same figure.