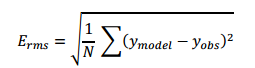
**ME 635: Modeling and Simulation**

**Homework #4: (use Excel, Matlab or any other software)**

1. **(20 Pts):** For the data given in ***HW4\_Problem1.txt*** ( two comma separated values), find :
   1. Coefficients for the best-fit quadratic model and the RMS error.
   2. Find the coefficients a0 and a1 if ***ymodel = a0\*x +a1\*sinh(x)*** and the RMS error
   3. Find the coefficients b0 and b1 if ***ymodel = b0\*x2 +b1\*exp(x)***

**Show plots for all fits. You may use Excel or any other software of your choice**.

**RMS Error is defined as**: 

1. **(20 Pts):** For the data given in **HW4\_problem2.txt** (two comma separated values: X,Y), find:
   1. Best-fit cubic model for the entire regime (0 ≤ X ≤ 1)
   2. Two piece-wise cubic models, first fit, f1(x), is valid from 0 ≤ X ≤ 0.5 and the second fit, f2(x) is valid from: 0.5 < X ≤ 1. (Note: the point X=0.5 belongs to the first fit).
   3. For the fits determined in 3(b), Plot the two functions f1(X) and f2(X) and comment on the continuity (C0 and C1: data and slope continuity) of the two models at X = 0.5. If f2(X) is extrapolated to X = 0.5.
2. **(30 Pts):** For the data given in **HW4\_Problem3.txt** (two comma separated values: X, Y), model with two piece-wise polynomial models, a cubic function (f1(X)) to fit from 0 ≤ X ≤ 0.5 and a quartic (4th order - f2(X)) to fit from 0.5 ≤ X ≤ 1, such that f2(X) maintains both C0 and C1 continuity at X = 0.5.

**Hint:** Use two independent variables X and X1 such that X1 = X – 0.5; first domain then will be 0 <= X <= 0.5 and the second domain will be 0 <= X1 <=0.5. Therefore C0 continuity requires f1(x=0.5) = f2 (x1 = 0). This makes the algebra easier.

1. **(30 Pts):** Determine polynomial interpolation, T(x) = Σ Ti Ni(x); where x = {0,..,1} and i=1...5; such that T(x=0) = T1, T(x=1) = T2, T(x=0.5) = T3, T(X=0.25)= T4 and T(x=0.75) = T5. Plot the five interpolation functions, Ni(x).

Given T1 = 100, T2 = 100, T3=160, T4=120, T5=130; Plot the temperature field, T(x) and the five interpolation functions (Ni(x), i=1…….5) Interpolation functions.