AEM 685: Final

Due on 12/01/2015

Important: Please work independently. You are allowed to use Matlab, Maple, Mathematica, your notes and books. Show all your work so that partial grades can be assigned. The intention of the examination is not related to programming.

Problem 1: For the optimization problem,

$$Minmize \quad f(x) = \sin(0.1 + 2x)/(0.1 + x)$$

$$Sub\ to \ \ 0 \le x \le 6$$

Use the samples at *x = 0, 3, 4* and *6* to construct the Kriging surrogate. Find the minima of the function using GA via surrogate model. Find the next sample using Expected Improvement method. (35 points)

Problem 2: For Problem 1, use the samples, at *x = 0, 3, 4, 5* and *6* to construct surrogate using polynomial response method via linear regression. Use cubic polynomial like

$$\hat{f} = a_0 + a_1 x + a_2 x^2 + a_3 x^3 \qquad (1)$$

Find the all coefficients of surrogate model. Predict the RMS error, sum of square error, standard error, R^2 and adjusted R^2 values. Find the location of maximum standard error and maximum standard error of the surrogate. Find the minima of fitted surrogate with five samples.

Now add sixth sample using D-optimal, A-optimal and G-optimal criteria. Fit the polynomial response surface using Eq. (1) via linear regression and obtain surrogate coefficients. And find the optimal solution. (35 points)

Problem 3: For the optimization problem,

$$Minimize\ f(x_1, x_2): x_1^4 - 2x_1^2 x_2 + x_1^2 + x_1 x_2^2 - 2x_1 + 4$$

$$\text{Sub to: } h(x_1, x_2): x_1^2 + x_2^2 - 2 = 0$$

$$g(x_1, x_2): 0.25x_1^2 + 0.75x_2^2 - 1 \le 0$$

$$0 \le x_1 \le 4$$

$$0 \le x_2 \le 4$$

obtain the stationary point problem using Karesh-Khun-Tucker necessary condition (first-order). Prove that the obtained solution is minima by proving sufficient condition (second-order condition). (30 points)