

Quality Engineering and Design of Experiments, Spring 2017

Homework #2

Due: 2017/04/06, 09:10

1. (35 pts) A certain chemical reaction is designed to check the main effects of three factors (A, B, and C) and their interaction effects during the reaction process. Suppose each factor has two levels; in this 2^3 experiment, one observation is collected in each factor level combination, as shown in Table 1.
 - (a) Establish the response table, and determine the effects of the three factors (E_A, E_B, E_C) and their interaction effects ($E_{A \times B}, E_{B \times C}, E_{C \times A}, E_{A \times B \times C}$).
 - (b) Make the response graph for the three factors.
 - (c) Make the interaction graph for the three factors (A vs. B, B vs. C, C vs. A, C vs. A \times B).
 - (d) Establish the generalized linear model for this reaction process.

Table 1 2^3 design and observation

Exp.	Factors			Interactions				y
	A	B	C					
1	-1	-1	-1					7.8
2	+1	-1	-1					5.8
3	-1	+1	-1					11
4	+1	+1	-1					10.3
5	-1	-1	+1					4
6	+1	-1	+1					2.8
7	-1	+1	+1					6.5
8	+1	+1	+1					5.3

2. (15 pts) The additive model for four factors can be represented as the following equation:

$$\eta(A, B, C, D) = \bar{\eta}_{A_i} + \bar{\eta}_{B_j} + \bar{\eta}_{C_k} + \bar{\eta}_{D_l} - 3\bar{\eta}$$

Please derive the above equation.