

Quality Engineering and Design of Experiments, Spring 2017

Homework #6

Due: 2017/06/01, 09:10

1. (40 pts) A study of a two-roller belt-drive mechanism is analyzed. The quality characteristic, y , for this problem is the location of the edge of the belt. Ideally the belt does not wander or oscillate laterally as the belt moves around the two rollers. The location can be measured using an edge detecting device. There are four control factors for this experiment. They are A: drive roller diameter; B: film tension; C: idler roller diameter; and D: idler roller mounting. The L9 orthogonal array experiment and the resulting data for the belt-drive mechanism are shown in the Table below. In this study, the mean value is not critical at all. Instead, it is critical that the edge location does not vary. Therefore, the S/N ratio below is used for the analysis:

$$S/N = -10 \times \log_{10} \left(\frac{S_n^2}{\bar{y}^2} \right)$$

Run	A	B	C	D	y_1	y_2
1	1	1	1	1	0.70	0.40
2	1	2	2	2	0.64	0.60
3	1	3	3	3	0.55	0.50
4	2	1	2	3	0.66	0.55
5	2	2	3	1	0.73	0.50
6	2	3	1	2	0.71	0.65
7	3	1	3	2	0.64	0.40
8	3	2	1	3	0.50	0.45
9	3	3	2	1	0.39	0.25

Establish (1) the response table using S/N ratios; (2) the ANOVA table such as Table 5.3-6 in the lecture slides. You have to show how to calculate the values in the two tables.

Note: (1) If you need to “pool some control factors” to generate the error data, make sure that the generated error’s DOF is 4. (2) Use the 90% confidence level to determine the significance of control factors.