8.10:

An article by J. J. Pignatiello Jr. and J. S. Ramberg in the *Journal of Quality Technology* Vol. 17, 1985, pp. 198-206) describes the use of a replicated fractional factorial to investigate the effect of five facgtors on the fere height of leaf springs used in an automotive application. The factors are A = furnace temperature, B = heating time, C = transfer time. D = hold down time, and E = quench oil temperature. The data are shown below:

Table : 8.10 Data

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Furnace Temp | Heating Time | Transfer Time | Hold Time | Quench Temp | Free Height |
| 1 | 1 | 1 | 1 | 1 | -1 | 7.81 |
| 2 | 1 | 1 | -1 | -1 | 1 | 7.56 |
| 3 | 1 | -1 | -1 | 1 | 1 | 7.88 |
| 4 | -1 | 1 | -1 | 1 | -1 | 7.5 |
| 5 | -1 | -1 | -1 | -1 | 1 | 7.5 |
| 6 | -1 | 1 | -1 | 1 | -1 | 7.56 |
| 7 | -1 | 1 | 1 | -1 | -1 | 7.56 |
| 8 | -1 | -1 | 1 | 1 | -1 | 7.88 |
| 9 | -1 | -1 | -1 | -1 | 1 | 7.25 |
| 10 | -1 | 1 | -1 | 1 | 1 | 7.5 |
| 11 | 1 | 1 | -1 | -1 | -1 | 7.56 |
| 12 | 1 | -1 | 1 | -1 | -1 | 8.06 |
| 13 | -1 | 1 | -1 | 1 | 1 | 7.5 |
| 14 | -1 | -1 | -1 | -1 | -1 | 7.81 |
| 15 | 1 | -1 | 1 | -1 | 1 | 7.62 |
| 16 | -1 | 1 | -1 | 1 | -1 | 7.5 |
| 17 | -1 | 1 | -1 | 1 | 1 | 7.56 |
| 18 | 1 | -1 | -1 | 1 | 1 | 7.88 |
| 19 | -1 | 1 | 1 | -1 | 1 | 7.25 |
| 20 | 1 | -1 | 1 | -1 | -1 | 7.69 |
| 21 | 1 | -1 | 1 | -1 | 1 | 7.56 |
| 22 | -1 | 1 | 1 | -1 | -1 | 7.44 |
| 23 | 1 | -1 | -1 | 1 | 1 | 7.44 |
| 24 | 1 | 1 | -1 | -1 | -1 | 7.59 |
| 25 | 1 | 1 | -1 | -1 | 1 | 7.63 |
| 26 | -1 | -1 | 1 | 1 | -1 | 7.54 |
| 27 | -1 | 1 | 1 | -1 | -1 | 7.52 |
| 28 | -1 | 1 | 1 | -1 | 1 | 7.18 |
| 29 | -1 | -1 | -1 | -1 | -1 | 7.78 |
| 30 | 1 | -1 | -1 | 1 | -1 | 7.88 |
| 31 | 1 | 1 | 1 | 1 | 1 | 7.5 |
| 32 | 1 | 1 | 1 | 1 | 1 | 7.81 |
| 33 | -1 | -1 | 1 | 1 | -1 | 8 |
| 34 | 1 | 1 | -1 | -1 | -1 | 7.75 |
| 35 | 1 | -1 | -1 | 1 | -1 | 8.15 |
| 36 | 1 | -1 | -1 | 1 | -1 | 8.18 |
| 37 | -1 | 1 | 1 | -1 | 1 | 7.18 |
| 38 | 1 | 1 | 1 | 1 | -1 | 7.56 |
| 39 | -1 | -1 | 1 | 1 | 1 | 7.32 |
| 40 | -1 | -1 | 1 | 1 | 1 | 7.44 |
| 41 | 1 | 1 | 1 | 1 | -1 | 7.69 |
| 42 | -1 | -1 | 1 | 1 | 1 | 7.44 |
| 43 | 1 | -1 | 1 | -1 | 1 | 7.69 |
| 44 | 1 | 1 | -1 | -1 | 1 | 7.75 |
| 45 | 1 | -1 | 1 | -1 | -1 | 8.09 |
| 46 | 1 | 1 | 1 | 1 | 1 | 7.59 |
| 47 | -1 | -1 | -1 | -1 | -1 | 7.78 |
| 48 | -1 | -1 | -1 | -1 | 1 | 7.12 |

8.11:

An article in *Industrial and Engineering Chemistry* ("More on Planning Experiments to Increase Research Efficiency," 1970, pp. 60-65) Uses a 25-2 design to investigate the effect of A = condensation temperature, B = amount of material 1, C = solvent volume , D = condesation time, and E = amount of material 2 on yield. The results obtained are as follows:

e = 23.2, ad = 16.9, cd = 23.8, bde = 16.8, ab = 15.5, bc = 16.2 ace = 23.4, abcde = 18.1

8.12

8.13

8.17