HW-Week 9

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Problem 5.9

```
library(GAD)
```

```
## Loading required package: matrixStats
```

```
## Loading required package: R.methodsS3
```

```
## R.methodsS3 v1.8.2 (2022-06-13 22:00:14 UTC) successfully loaded. See ?R.methodsS3 for help.
```

```
drill_speed <- c(rep(125,8),rep(200,8))
feed_rate <- c(rep(seq(0.015,0.060,0.015),4))
response <- c(2.70,2.45,2.60,2.75,2.78,2.49,2.72,2.86,2.83,2.85,2.86,2.94,2.86,
              2.80,2.87,2.88)
drill_speed <- as.fixed(drill_speed)
feed_rate <- as.fixed(feed_rate)
dat <- data.frame(drill_speed,feed_rate,response)
dat
```

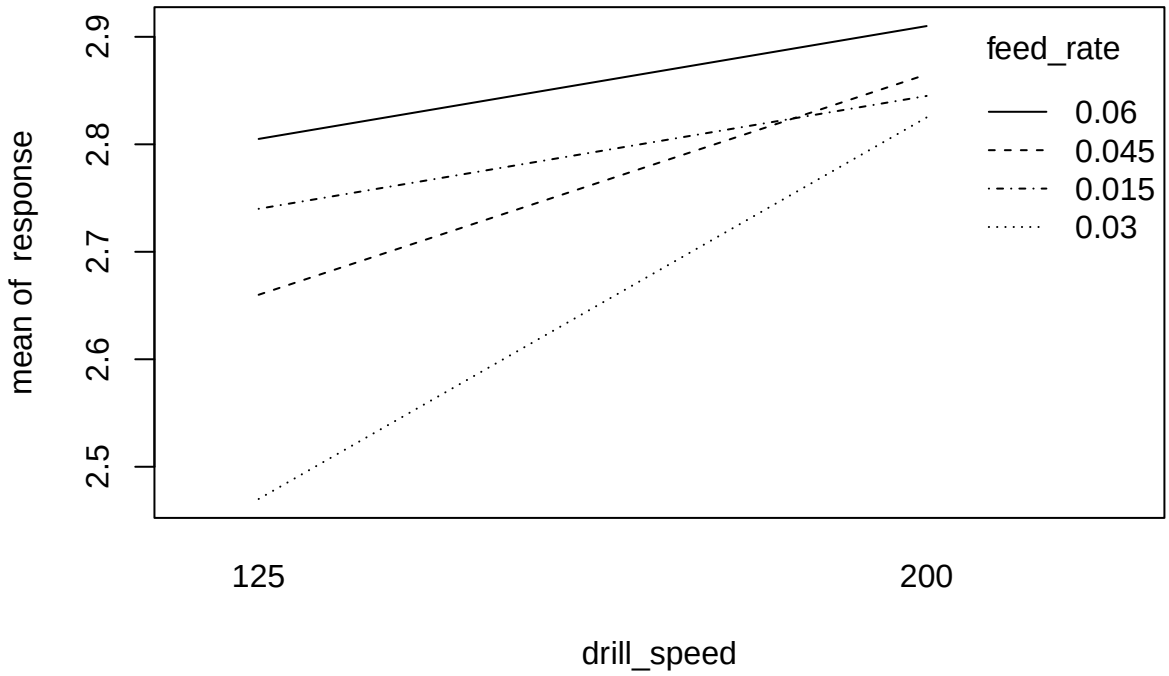
```
##    drill_speed feed_rate response
## 1          125     0.015     2.70
## 2          125      0.03     2.45
## 3          125     0.045     2.60
## 4          125      0.06     2.75
## 5          125     0.015     2.78
## 6          125      0.03     2.49
## 7          125     0.045     2.72
## 8          125      0.06     2.86
## 9          200     0.015     2.83
## 10         200      0.03     2.85
## 11         200     0.045     2.86
## 12         200      0.06     2.94
## 13         200     0.015     2.86
## 14         200      0.03     2.80
## 15         200     0.045     2.87
## 16         200      0.06     2.88
```

```
model <- aov(response~drill_speed+feed_rate+drill_speed*feed_rate,data=dat)
summary(model)
```

```
##                      Df  Sum Sq Mean Sq F value   Pr(>F)
## drill_speed           1 0.14822 0.14822  57.010 6.61e-05 ***
## feed_rate             3 0.09250 0.03083  11.859  0.00258 **
## drill_speed:feed_rate 3 0.04187 0.01396   5.369  0.02557 *
## Residuals             8 0.02080 0.00260
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
interaction.plot(drill_speed,feed_rate,response)
```



Model Equation: $Y_{ijk} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \epsilon_{ijk}$

Hypothesis Test:

$H_0 : \alpha_i = 0 \forall$ i

$H_a : \alpha_i \neq 0$ for some i

$H_0 : \beta_j = 0 \forall$ j

$H_a : \beta_j \neq 0$ for some j

$H_0 : \alpha\beta_{ij} = 0 \forall$ ij

$H_a : \alpha\beta_{ij} \neq 0$ for some ij

Conclusions: From the summary of the model, we see that the p value (0.02557) of the interaction term is less than $\alpha = 0.05$ level so we reject the Null hypothesis H_0 which indicates that the interaction term is significant.Also, the interaction plot shows that there is an interaction between these two factors. Since the interaction is present here so the main affect of the factors don't make sense because affect of the feed rate depends on the drill speed.