



Third ENBIS Conference

Optimization of a Brake Prototype as Consequence of a Successful DOE Training

Lluís Marco Technical University of Catalonia (UPC)

Juan Cuadrado Robert Bosch Braking Systems

Xavier Tort-Martorell Technical University of Catalonia (UPC)







Departament d'Estadística
i Investigació Operativa
UNIVERSITAT POLITÈCNICA DE CATALUNYA

Barcelona, 22nd August 2003


The People



Xavier
Lluís
Guillermo
Lourdes




UPC Team



BOSCH BOSCH Team

Manolo
Herr Bosch
Juan
Paco
Miquel
Artur
Carles
Paco

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Optimization of a brake prototype as consequence of a successful DOE training

2 / 20

Planning of a Real Experiment

The problem to be faced: maximizing rupture load in a new servo break that they were designing. This was a topic that they were all knowledgeable, they had worked a lot on it but still had some insecurities on how some variables affected the response.

From a long initial list of possible factors, only 5 were chosen:

	Factor	Low level (-1)	High level (+1)
A	Structure Fixation	A	B
B	Shell radius 1 (mm)	1	2
C	Shell radius 2 (mm)	2	6
D	Number of screws	16	24
E	Angle (°)	0	10

Factors and levels have been slightly changed due to confidential restrictions

Before conducting the experiment, we asked technicians to write down what they already knew about the process: which main effects and interactions were more likely to be significant.

Optimization of a brake prototype as consequence of a successful DOE training
3 / 20

Conducting and Analyzing the Experiment

These were the results:

A	B	C	D	E	Response
1	1	-1	-1	1	1736
-1	-1	-1	-1	1	1741
1	-1	1	1	-1	2209
1	1	1	1	1	2224
-1	1	-1	-1	-1	1792
1	1	-1	1	-1	2209
-1	-1	-1	1	-1	2163
1	-1	-1	-1	-1	1675
1	-1	-1	1	1	2012
-1	1	1	1	-1	2290
1	-1	1	-1	1	1750
-1	1	1	-1	1	1741
-1	1	-1	1	1	1508
-1	-1	1	-1	-1	1604
1	1	1	-1	-1	1802
-1	-1	1	1	1	2214

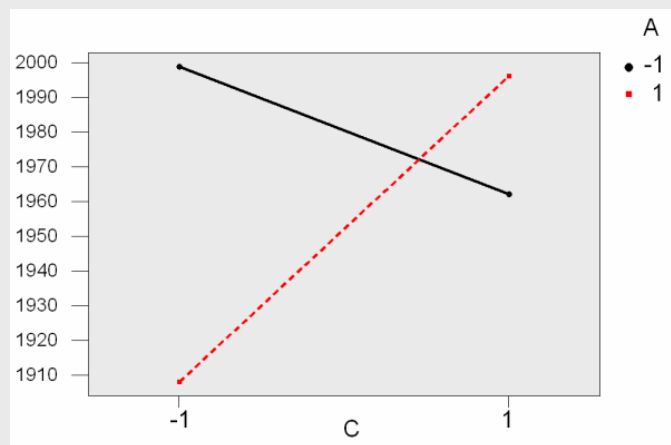
And the effects in normal probability plot:

Optimization of a brake prototype as consequence of a successful DOE training
4 / 20

Final Conclusions on the Experiment

Final conclusions on the experiment by Bosch people were:

- Number of screws is important (main effect). 24 configuration is better than 16 as it maximizes rupture load.
- A second significant effect is shell radius 1. It is recommended to increase shell radius 1.
- Possible interaction between structure fixation and shell radius 2.



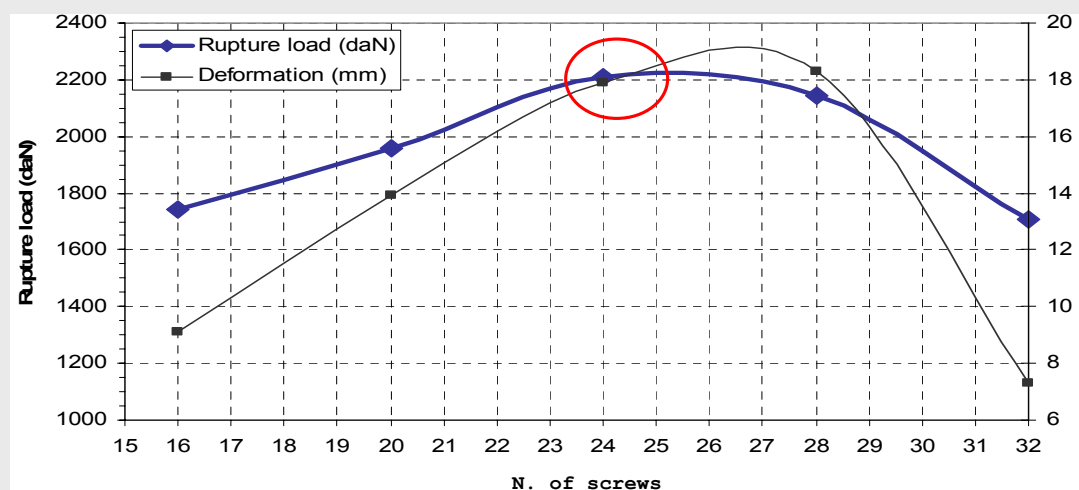
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The Surprise: one Factor has a Huge Effect

The experiment revealed Number of Screws as a factor with a huge effect in rupture load. This was a surprise, because some people thought it was not that important.

As number of screws does not interact with any other factor, technicians made further experiments just changing that factor (16, 20, 24, 28 and 32 screws) . 24 is the best choice for maximizing rupture load.



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