

DOE Fractional Factorial Analysis

This guide provides instructions on analyzing fractional factorial experiments (experiments where not every possible treatment combination in a full factorial design is run) using the Fit Model platform.

Specify the Model and Analyze

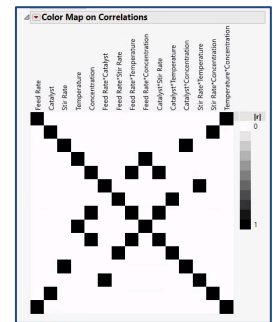
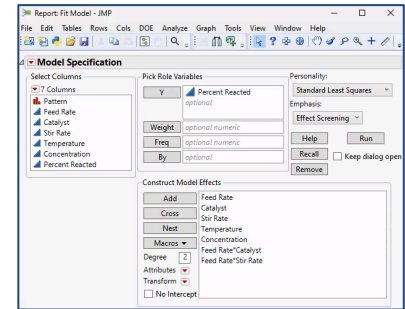
- Experiments designed in JMP® will have a **Model** script saved to the data table. The model specification window will be populated with this model. To generate the model manually:

- Select **Analyze > Fit Model**.
- Click on the response under **Select Columns**, and click **Y**.
- Select the factors of interest, and click **Add** (under **Construct Model Effects**).
- To add specific interaction terms, select the variables under **Select Columns** and click **Cross**. Click Run to fit the specified model. In this experiment, all but two of the 2-way interactions are confounded with main effects.
 - Feed Rate*Catalyst = Stir Rate*Temperature
 - Feed Rate*Stir Rate = Catalyst*Temperature, and

One way to view the level of confounding of the factors is to examine the Color Map of Correlations in the Evaluate Design report. Here you'll see the confounding between the 2-way interactions and main effects as well as the confounding between the two 2-way interactions listed above.

Reactor 8 Runs.jmp (Help > Sample Data Folder > Design Experiment).

This is a unrepliated 8 run 2⁵⁻² Resolution III



- Click **Run** to fit your specified model

Note: If your design is **saturated** (there are no error degrees of freedom) as the case here, the Effects Summary, Parameter Estimates, and Effect Tests tables will not show test statistics and p-values. Select **Estimates > Sorted Estimates** from the top red triangle to see p-values based on **Lenth Pseudo Standard Error** (PSE, an estimate of residual standard error).

Term	Estimate	Relative Std Error	Pseudo t-Ratio	Pseudo p-Value
Catalyst(1,2)	10.125	0.353553	1.38	0.2837
Feed Rate*Stir Rate	6.125	0.353553	0.84	0.4793
Temperature(140,180)	5.875	0.353553	0.80	0.4954
Feed Rate(10,15)	-4.875	0.353553	-0.67	0.5649
Concentration(3,6)	-3.375	0.353553	-0.46	0.6839
Stir Rate(100,120)	1.875	0.353553	0.26	0.8185
Feed Rate*Catalyst	0.375	0.353553	0.05	0.9632

No error degrees of freedom, so ordinary tests uncomputable.
Relative Std Error corresponds to residual standard error of 1.
Pseudo t-Ratio and p-Value calculated using Lenth PSE = 7.3125 and DFE=2.3333

- Reduce the model** (removing terms) as desired. Here we removed the 2-way interaction with the highest pseudo p-value (Feed Rate*Catalyst = Stir Rate*Temperature). Upon doing that, there is now a single degree of freedom to estimate experimental error. Test statistics and p-values will now appear in the Effect Summary table. Recall that all the main effects are confounded with 2-way interactions and that the Feed Rate * Stir Rate interaction is confounded with Catalyst*Temperature. Thus it is unknown if it's the main effects or the 2-way interactions they are each confounded with that have a significant effect on the response. Similarly, it is also unknown which of the two 2-way interactions are impacting the response.

Source	Logworth	PValue
Catalyst(1,2)	1.628	0.02357
Feed Rate*Stir Rate	1.410	0.03893
Temperature(140,180)	1.392	0.04058
Feed Rate(10,15)	1.311	0.04867 ^
Concentration(3,6)	1.152	0.07045
Stir Rate(100,120)	0.901	0.12567 ^

(^*) denotes effects with containing effects above them

Visit **Design of Experiments Guide** in **JMP Help** to learn more.