

$$\bar{\Pi} = \frac{1}{2} \sum_e \{u\}^T \cdot [K] \cdot \{u\} - \{u\}^T \cdot \{F\}$$

FEM SOFTWARE AND SERVICES



Understand your Design

Manual Variation

PRACE Autumn School 2013 - Industry Oriented HPC Simulations, September 21-27,
University of Ljubljana, Faculty of Mechanical Engineering, Ljubljana, Slovenia

Understand your Design

Example: Notch



cRad = 7
thck_l = 5
cthck = 3
thck = 8
nthck = 0.42
nRad = 1
blend = 10

Which parameter shall be taken for a manual variation?

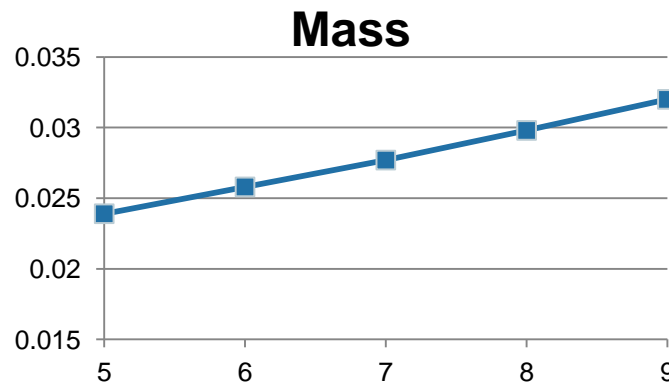
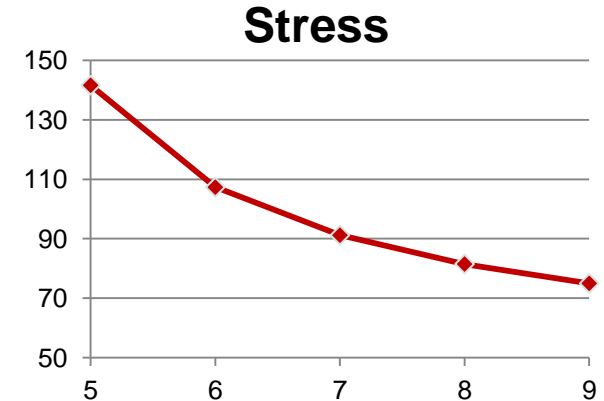


Understand your Design

Example: Notch

- Take 1 Parameter: Thickness (thck) and vary it between 5 and 9
- The evaluation of the results is quite simple.
- Just use two graphs in Excel.

Thck	Stress	Mass
5	141.6	0.0239
6	107.34	0.0258
7	91.2	0.0277
8	81.5	0.0298
9	75	0.032



Understand your Design

Example: Notch

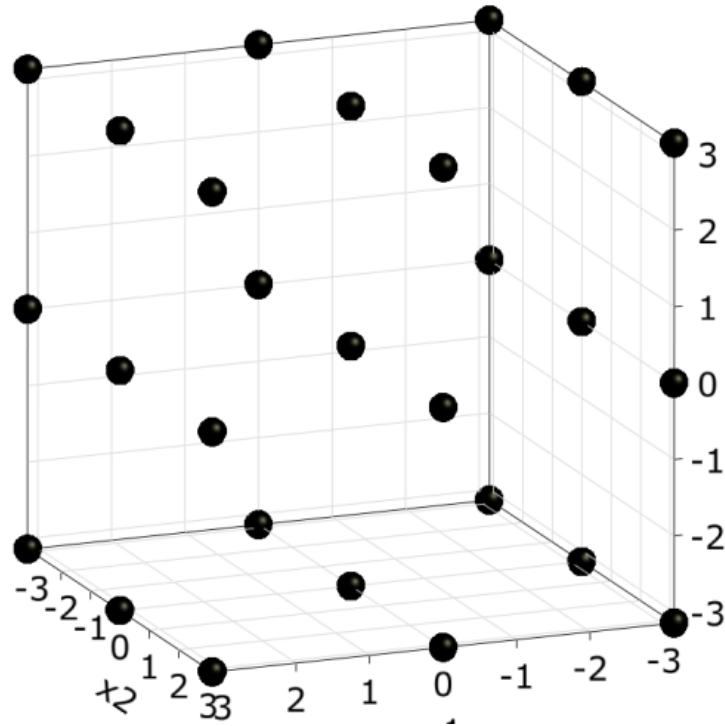
- 2nd parameter: cThck, variation: 2 ... 3.5
- Which combination to create?
- 3 Designs per Parameter (low-mid-high): $2^3 = 8$ designs.
- Check the effect.
- Taken the right parameter?

cThck	Thck	Stress	Mass
2	5	127.9	0.0176
2	7	95.1	0.0213
2	9	82.1	0.0255
2.75	5	135.4	0.0223
2.75	7	91.9	0.0260
2.75	9	76.9	0.0303
3.5	5	181.4	0.0274
3.5	7	96.5	0.0311
3.5	9	74.5	0.0354

Understand your Design

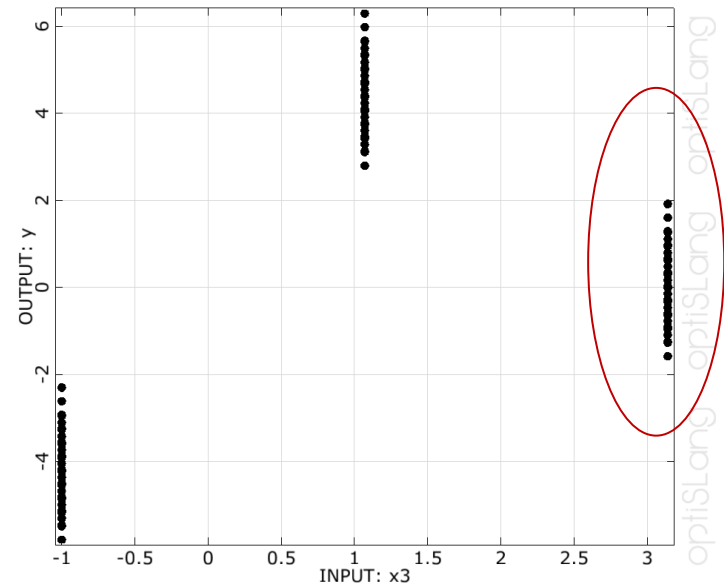
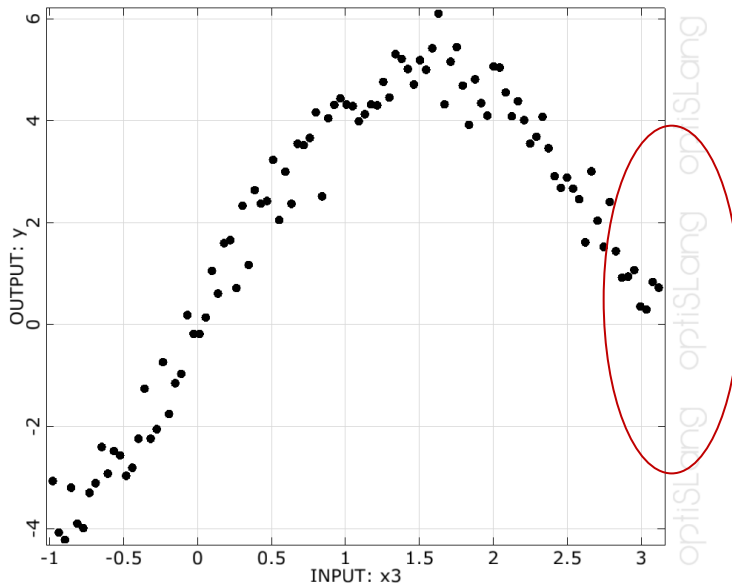
Manual variations

- All 7 parameters: $3^7 = 2187$ designs!
- Do you want to set this up manually?
- Can you ensure that all designs can be regenerated?
- Information useful?



Understand your Design

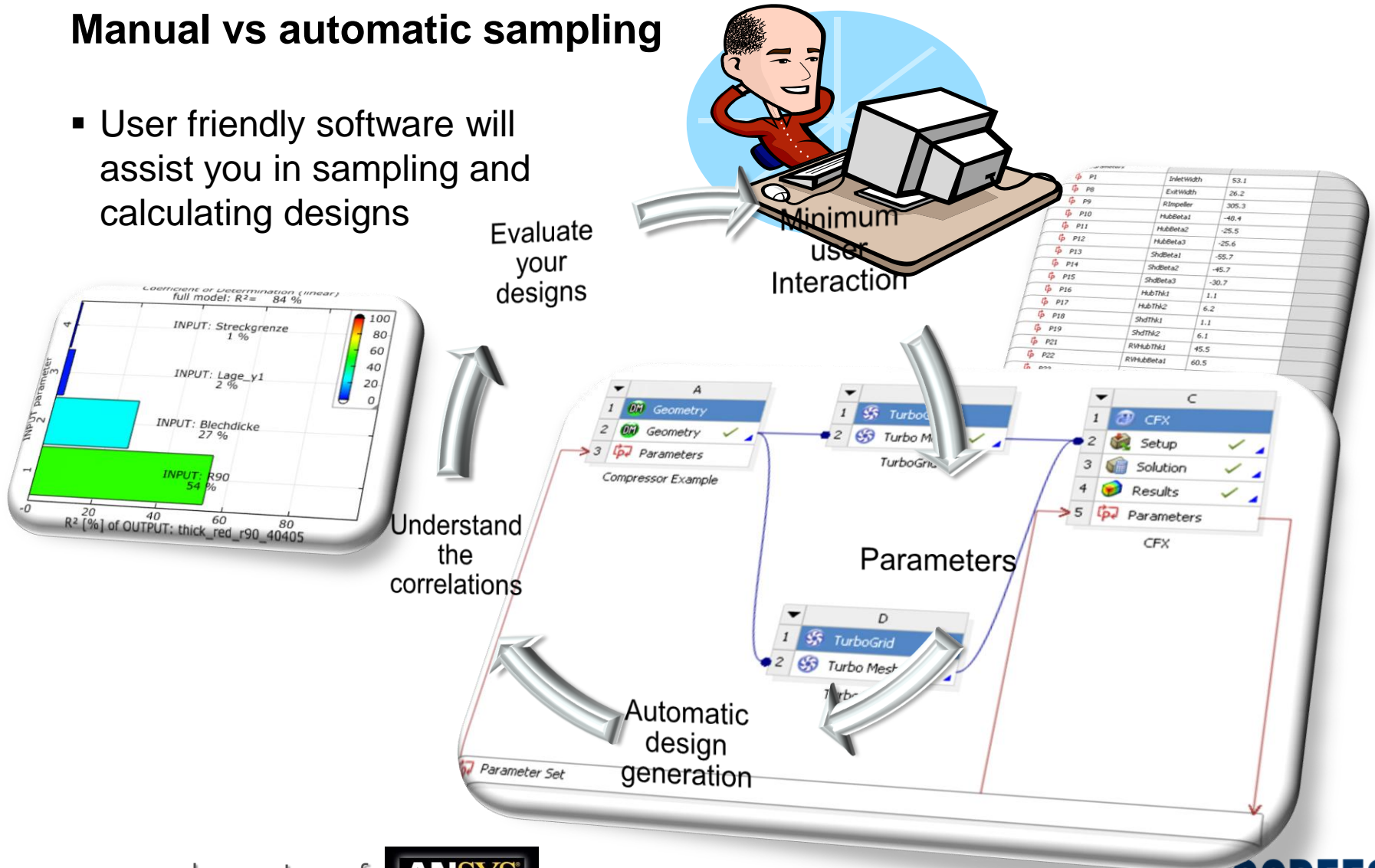
- Manual variation: normally 3 designs (low-mid-high)
- Failed design: loss of large amount of information
- Stochastic sampling:
 - No loss of information, best representation of variation space!



Understand your Design

Manual vs automatic sampling

- User friendly software will assist you in sampling and calculating designs



Understand your Design

The automatic sampling

