Sobol sensitivity indices

Main idea: Decompose the variance of model output in terms of contribution from individual input parameters and their combinations.

$$V(y) = \sum_i V_i + \sum_{i,j} V_{i,j} + \text{higher order terms}$$

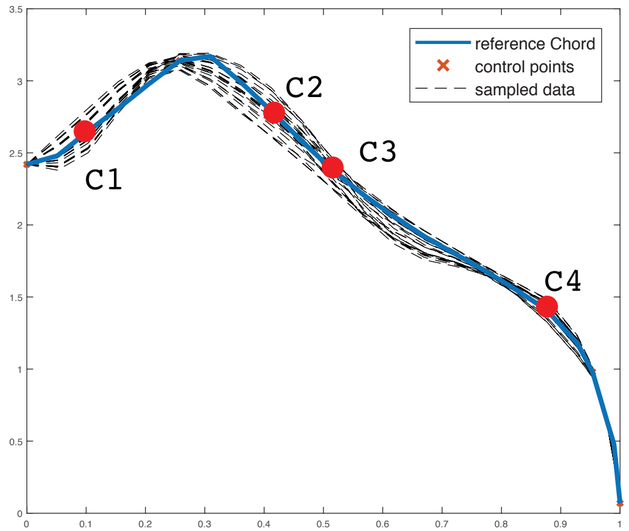
First order indices

$$S_1 = \frac{V_1}{V}, S_2 = \frac{V_2}{V}, \ldots$$

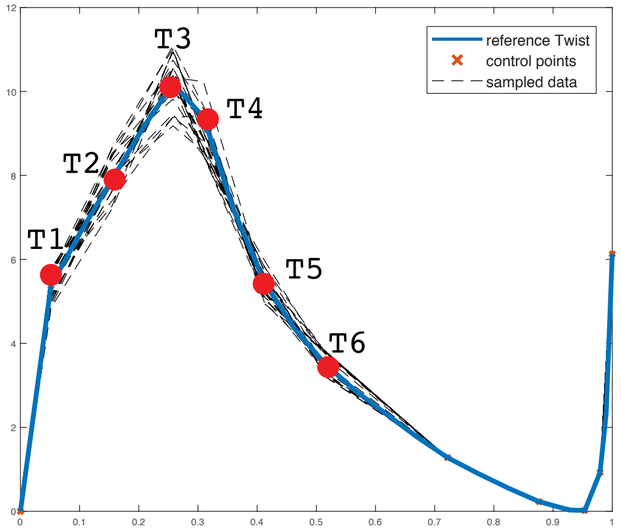
Second order indices

$$S_{1,2} = \frac{V_{1,2}}{V}, S_{1,3} = \frac{V_{1,3}}{V}, \ldots$$

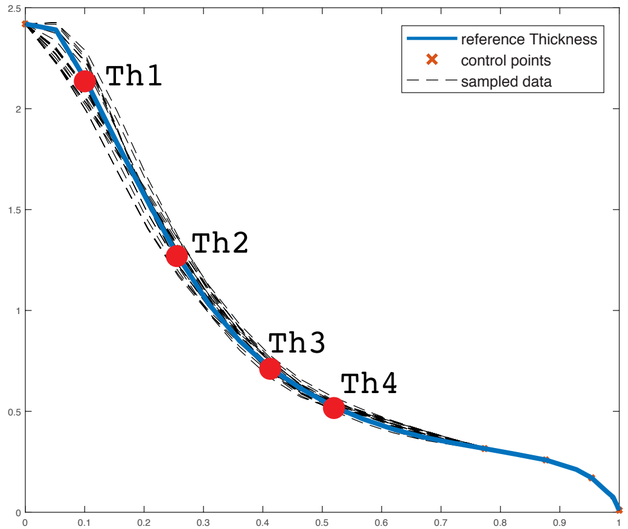
Uncertain parameters



Chord



Twist

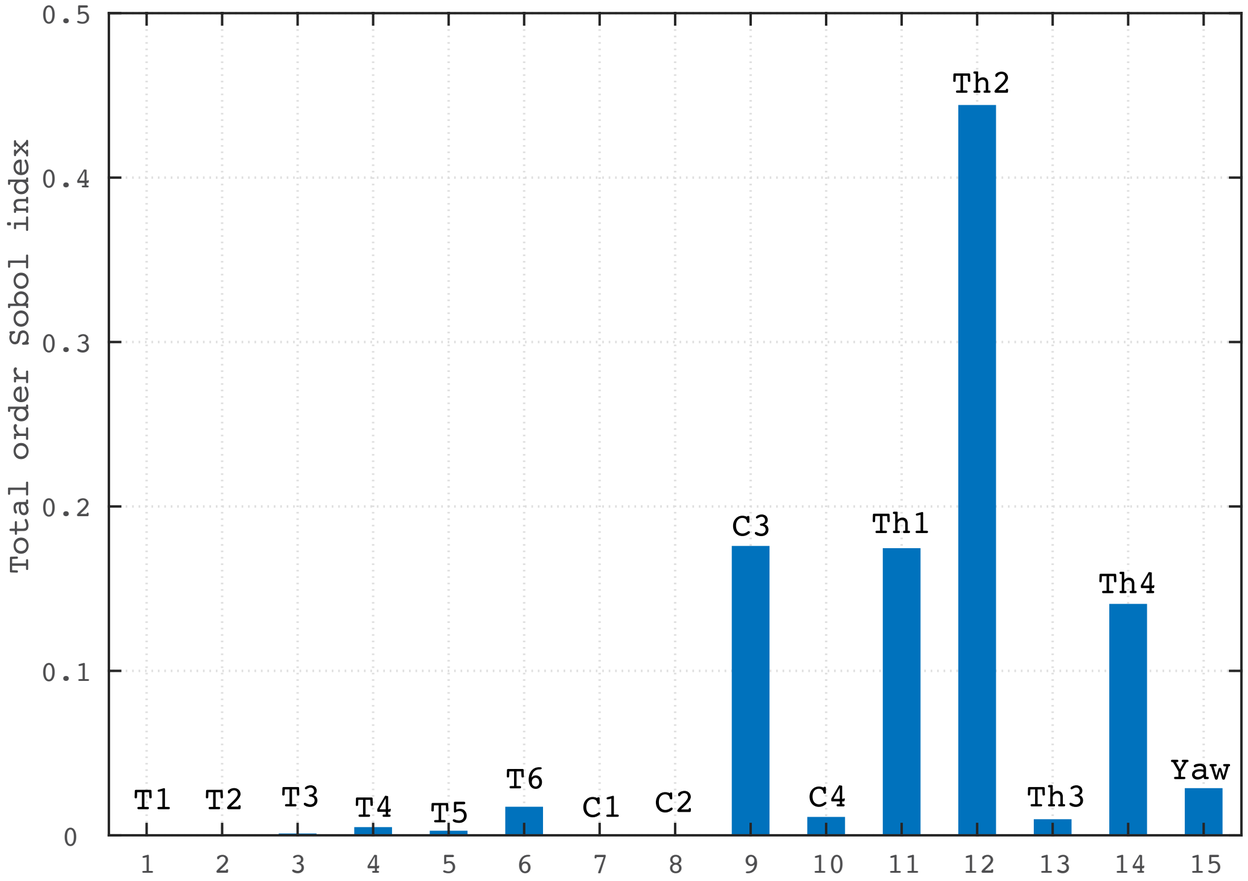


Thickness

10% (uniform) uncertainty in for each control point

Yaw: Truncated Gaussian distribution with mean = 0, std = 2, and bound [-10,10] degrees

Sensitivity analysis: Power output



Sensitivity analysis: Axial force