UQ 6310 Homework6, Yu Wang

To calculate the first-order index S_i, the following equation is used:

$$S_i = \frac{V_i}{V(y)} = \frac{V_{x_i}(E_{x_{-i}}(y|x_i))}{V(y)} \tag{1}$$

Assuming $E1, E2, E3, E4, N(Noise)$ follow the uniform distribution, where the upper bounds are $30000, 28000, 27000, 29000$ and the lower bounds are $25000, 24000, 23000, 20000$. By double loop sampling from the specified distributions for each variable (100 samples inner loop, 100 samples outer loop), we calculate the elongation value using RGP model and PCE model respectively. Based on the input and the output, the sensitivity analysis is performed. The results are as follows:

$$V(y)_{RGP} = 0.00118, \quad V(y)_{PCE} = 0.00102 \tag{2}$$

$$V(i)_{RGP} = [0.00109, 0.000025, 0.000032, 0.000023, 0.000033] \tag{3}$$

$$V(y)_{PCE} = [0.00093, 0.000027, 0.000025, 0.000029, 0.000022] \tag{4}$$

Based on the results above, we can clear see that in the RGP model, the variance v_i caused by variable x_i individually is very close to the one in the PCE model, which further validates the double looping method to perform the sensitivity analysis.