Manual for Sobol' Index Robustness Codes

Joseph Hart[1]

[1]Department of Mathematics, North Carolina State University, Raleigh, NC

This collection of codes computes Sobol' indices and measures their robustness with respect to uncertainty in the distribution of the input variables. The robustness method is based on the papers [1, 2]. The codes are organized into two subdirectories, *Robustness_Codes/Joint_Perturbations* and *Robustness_Codes/Marginal_Perturbations*, which correspond to methods from [1] and [2], respectively. Though these methods share many similarities, there are several important differences. To emphasize this, the codes are organized in separate subdirectories with separate documentation, which may be found in the subdirectories. The user should read [1, 2] prior to reading the documentation.

The robustness algorithms use for loops and logical operators heavily, as a result the Matlab implementation is inefficient. To remove this inefficiency, the computationally intensive portion of the algorithm has been converted to C code and precompiled using the Matlab Coder tool. This was done with Matlab 2018a on Macintosh running OS 10.13.6. If the precompiled functions do not execute, the user may easily generate them using Matlab Coder on their machine. This is strongly recommended as the algorithms benefit significantly from the C implementation.

The codes in *Robustness_Codes/Marginal_Perturbations* are only applicable for problems with independent input variables; whereas the codes in *Robustness_Codes/Joint_Perturbations* may be applied to problems with independent or dependent input variables. In the case of independent input variables, the script *Convert_Marginal_Robustness_Data_to_Joint_Robustness_Data.m* is used to format data generated in *Robustness_Codes/Marginal_Perturbations* to be used in *Robustness_Codes/Joint_Perturbations* without requiring any additional model evaluations. To do this, the user should

1 execute the codes in *Robustness_Codes/Marginal_Perturbations*

2 execute the script *Convert_Marginal_Robustness_Data_to_Joint_Robustness_Data.m*

3 load the data file generated by *Convert_Marginal_Robustness_Data_to_Joint_Robustness_Data.m*

4 execute Line 27 of *Robustness_Codes/Joint_Perturbations/Linear_Example/Driver.m*

References

[1] Joseph Hart and Pierre Gremaud. Robustness of the Sobol' indices to distributional uncertainty. *https://arxiv.org/abs/1803.11249. Under review*, 2018.

[2] Joseph Hart and Pierre Gremaud. Robustness of the Sobol' indices to marginal distribution uncertainty. *In preparation*, 2018.