

MIT Willcox Code Descriptions and Functional Summary

The MIT Willcox team codes may be found in the MITWillcoxCodes.zip file. After unzipping the file, the README file provides instructions for installation and execution of the codes.

Code Descriptions/Functional Summary:

The main codes in the .zip file are ComplexityMetric.m, SensitivityAnalysis.m, and ExampleDemonstration.m. The other .m files are supporting functions.

ComplexityMetric.m

The code ComplexityMetric.m is used to compute the complexity of a system given a quantity of interest. A quantity of interest refers to anything a designer or decision-maker cares about with respect to the system. For example, a quantity of interest could relate to some performance metric of a given system, cost estimates, schedule estimates, etc. The complexity metric is computed as the exponential of the information entropy of the probability distribution of the quantity of interest. This distribution is estimated using kernel density estimation within the ComplexityMetric.m code. To enable this density estimation, samples of the quantity of interest are required, which are assumed to be provided from a Monte Carlo simulation that has previously been executed by the user. With these samples and any information regarding the bounds of the quantity of interest distribution, the ComplexityMetric.m code can be executed and will provide the system complexity associated with that quantity of interest. Please see the help file (type help ComplexityMetric.m in the command line) for more information.

SensitivityAnalysis.m

The code SensitivityAnalysis.m is used to direct resource allocation procedures aimed at reducing system complexity. The code provides sensitivity indices for a given system factor (e.g., input, parameter, etc.) and a given quantity of interest. This index multiplied by 100 is the expected percentage reduction that could be achieved by complete knowledge of the given uncertain factor. The code takes samples of both the factor and the quantity of interest as input. These samples are assumed to be provided from a Monte Carlo simulation that has previously been executed by the user.

ExampleDemonstration.m

The code ExampleDemonstration.m is used to provide the user with a simple problem that steps through the process of inputting factor information, running a Monte Carlo simulation, estimating complexity, estimating sensitivity indices, and allocating resources aimed at reducing the system complexity. The demonstration problem is the analysis of an RLC circuit being used as a high-pass filter. The quantity of interest is the break frequency of the circuit and the system factors are the capacitance and inductance of the capacitor and inductor. More details can be found in the README file.