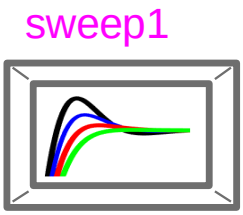
Parameter seep



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Henry Gras, 2017-05-01 09:28:00

1 Introduction

Single-parameter sweep device is utilized to define a parameter variation set to run parametric studies. The parametric analysis is started from a Parameter Sweep supervisor. The parameter can vary:

- **Step-by-step**. In that case, the parameter value is increased step-by-step from **Low-limit** to the **High limit**.
  If, during a time-step of a variation step, the input Test receives a value larger than 0, the process stops.
- **Bisection**. The Bisection is an efficient method to identify the value of a parameter which is a limit for a certain condition. The script repeatedly bisects an interval and then selects a subinterval in which the condition appears (see Figure 1). The condition is connected to the input Test of the device. It is true if a value larger than 0 is input for at least 1 time-step during the simulation, else it is false. If there is no change in the input Test between the interval limits, 'Out of the interval' is written in the Note attribute.
  When the convergence is based on the parameter interval size, the bisection stops when the interval is smaller than the convergence criterion (see Figure 1). If the convergence is based on the values taken by the input pin Test during the simulation, the bisection stops when the absolute values of the input pin during the whole simulation remain below the convergence criterion.
- **Pre-defined**. In that case, the values for each run are written in a table.
- **Statistically**

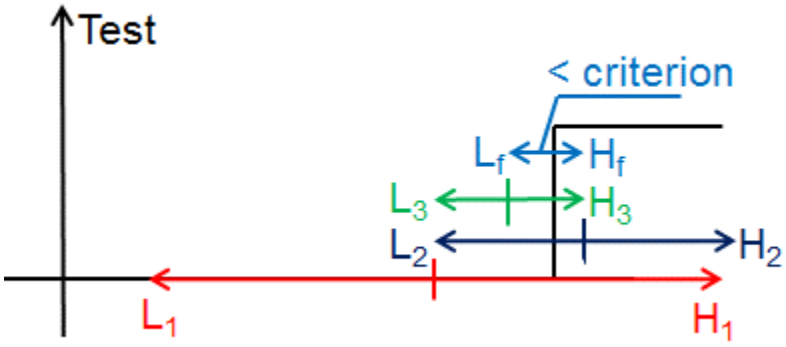

Figure 1: Bisection principle. L stand for Low-limit and H for High-limit. 1, 2 and 3 are the subinterval numbers and f the index of the last iteration.

The parameter is defined either:

- inside a standard-masked subcircuit (Black-Box) in which the parameter 'Parameter name' is used.

A value is assigned to 'Parameter name' at the end of the section Initial Values of the mask and the Black Box script is run. If a value of 'Parameter name' is assigned in the Black Box mask before the parameter sweep is launched, it is overwritten.

- as a Global Variable in which case the parameter is defined inside the Global data definitions field. If oGlobalData.parameterName is defined before the parameter sweep is launched, it is overwritten.
- In a configurable device in which can the parameter to vary is chosen among a list of available parameters.

According to the type of variation, a Load-Flow solution can be found before each

loop starts. Parameter sweeps are applicable for studies in Time Domain only.

A script which is called right before the Load-Flow solution is found and the Time domain simulation starts can also be defined.

Several Single-parameter variation devices can be coordinated to accomplish multi-parameter variation using the Parameter sweep supervisor device.

Warning: When the process is started, the only way to stop it is to kill the EMTPopt.exe and EMTPWorks process in the Windows Task Manager. Always save your design before starting a process.

2 Parameters

Data Tab

- **Parameter name**: if the parameter is defined in a default-type mask, write the name of the parameter as it appears in the mask. If it is defined in the Global Variable field, enter the name after oGlobalData. as it appears in the Global Variable field. Named Value (oGlobalData.NV) can be used (see Global Variable documentation).
- **Type of variation:** see 1 Introduction**. For Pre-defined**, each value of the table must be different.
- **Low limit:** see 1 Introduction**.** Initial value of the parameter. For Bisection, lower limit of the first loop section.
- **High limit:** see 1 Introduction. For Bisection, higher limit of the first loop section.
- **Criterion:** see 1 Introduction**.**
  For Step-by-step variation, this is the value of the step.
  For Bisection, this is the convergence criterion. The script repeatedly bisects an interval and then selects a subinterval in which the condition appears (see Figure 1). There is convergence when the length of a subinterval is smaller than **Criterion**.
- **Convergence based on:** for bisection type of variation only. Select the convergence decision method.
  - If the convergence criterion is applied on Test input values, the bisection stops when the absolute values inputs of the Test pin remain below the convergence criterion during the whole simulation.
  - If the convergence criterion is applied on Parameter interval size, the bisection stops when the difference between the high and the low values of the varied parameter is below the convergence criterion. This method is illustrated in Figure 1.
- **Add input pin to stop the process**: for Step-by-step Type of variation only. When this box is checked, the pin Test appears. If, during a time-step of a variation step, the input Test receives a value larger than 0, the process stops.
- **Re-run Load-Flow after the Parameter variation**: find Load-Flow solution at the beginning of each loop of the parameter sweep.
- **Extra script to call**: Script called right before the Time-domain simulation is run. It allows the user to write customized scripts which can be used either for data pre-processing or results post-

processing. The global variable Global_currentValue equals to the parameter value for the current iteration is available. Global_currentValue can be updated in the user-defined script in order to modify the current iteration parameter value.
The global variable Global_runAgain is available and true while the full parameter variation simulations are not completed. Global_runAgain can be set to false in the user-defined script in order to stop the variation process.
The global variable Global_reset is available and true when all the simulations are completed. It allows to build a reset function in the user-defined script.