# OEO simulation

1. System requirements

* DSP System Toolbox (8.1)
* MATLAB (7.13)
* Simulink (7.8)
* Simulink Coder (8.1)
* Signal Processing Toolbox (6.16)

-C/C++ compiler (Microsoft Visual C++ 2010 Express can be downloaded for free)

1. Installation

- Unzip the source files into the destination directory

- In the MATLAB command line run: "mex –setup" and follow the instructions - this will locate and select the installed compiler

1. Running the simulation

* Set the MATLAB "Current Folder" to the simulation source directory
* It is advisable to clear the memory before running the simulation ("clear all").
* Setting up parameters:
  + Open "ParamsFile.m" in the MATLAB editor – the file contains the parameters for the master and slave OEOs in two MATLAB structures. Set the desired parameters and run the script.
  + Open "test\_oeo\_dual\_discrete.mdl" from the MATLAB - this will open the Simulink program window.
  + In a small window near the "play button" ► the simulation time in seconds can be modified.

*Note: the amount of data that are saved to workspace is limited by a computer RAM*

* Press he "play" button ►. It will take a little longer to run the simulation for the first time, since the Simulink will compile a source code to C/C++. The simulation can be stopped or paused any time by pushing an appropriate button. The simulation time progress is shown at right bottom corner of the Simulink window
* The simulation records the master and the slave amplitude and phase versus time. The results can be observed at any moment (also during the simulation) by double-clicking the scope block in the Simulink window. In addition, the results are saved to the MATLAB workspace as a 1-D array: "MasterAmpl", "MasterPhase", "SlaveAmpl", "SlavePhase". The time interval "Ts" is set in "ParamsFile.m" file.

1. Running long simulation

Additional simulation model "test\_oeo\_dual\_long.mdl" records the same data with a 10000 slower rate the previous one. This enables to perform long-time simulations.

1. Data analysis – the phase noise spectrum can be estimated by the standard "pwelch" command. Notice the transient process of the amplitude convergence in the beginning of the simulation (see "showSpec.m" for example)
2. Advanced topic – rapid simulation.

It is possible to generate an executable (exe) stand-alone application – the most efficient and fastest way to run the code without a Simulink environment.

* Right-click the mouse somewhere in the middle of the Simulink window and select "Code generation". In the right bottom part find the "Build" button and press it – this will generate executable file at the current directory. Remember to run the "ParamsFile.m" to load the parameters into the MATLAB workspace.
* Close the Simulink and clear the MATLAB memory. Look at the "runSim.m" file for example of starting executable application. At the end a mat file containing the results will be saved in the current folder. It is also possible to run the code without the MATLAB (see runExe.bat).