

P-PP Research project title:
Pump-probe experiment modeling (using UPPEcore)

TASK:

Design a simulated test to measure medium nonlinear response. Set up a simulation in which the probe pulse passes through a thin slice of a medium where it experiences nonlinear phase shift (you may utilize simple Kerr model for the nonlinearity). A few hundred micron propagation through a nonlinear medium should be sufficient. Longer medium length would lead to distortion of the beam which we want to avoid in this case. This geometry represents e.g. nonlinear propagation through a gas jet. In a second subsequent simulation, simulate a reference pulse which is initially identical to the probe and switch off the nonlinearity (leaving chromatic dispersion on, set the nonlinear index to zero). Extract the electric field phase from both simulations and subtract the results this is a measure of the nonlinear phase shift. Show that the magnitude of the nonlinear phase shift thus obtained does correspond to the nonlinear index used in the simulation.

This kind of simulation set up may be used to test if the nonlinear medium plugin has been implemented correctly.

DELIVERABLE:

Report in pdf format. Input files for an example simulation plus illustrating data or graphics files.

OPTIONAL EXTENSION A:

Design a simulation that models SSSI experiment (look up a paper attached with the project P-RES). A simplified version may look as follows: Simulation is set up with two polarizations, one for pump, and one for probe and reference pulses. The probe pulse must overlap with the pump temporally. Obtain the temporal profile file (-T-) at the end of the simulation for a high and zero intensities of the pump and extract the phase difference from the resulting pulses in the second polarization components. Unlike in the base version of this project, here the intensity of the probe (and reference) pulse must be about 100 times smaller than that of the pump.

START-FROM-MATERIAL:

Work-package with the simulation template *wrk_090_Pump_Probe_Simulations* can serve as illustration. However, this project mimics a pump-probe experiment in a significantly simplified setup. In Option A you may choose to set this numerical experiment with three pulses: a strong pump, and weak reference and an identical weak probe co-propagating with the pump. This would be a model of the experimental method discussed in P-RES. The *wrk_090* template shows how to set up more than one polarization components.