1. Introduction

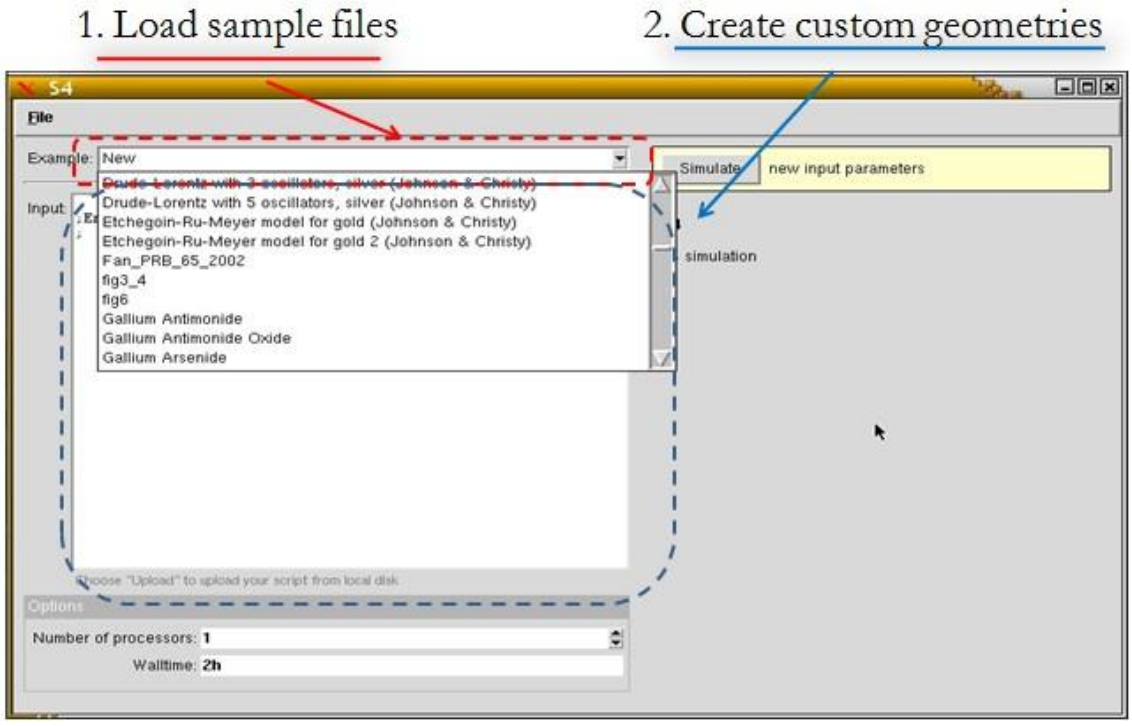
S^4 is a frequency domain code to solve layered periodic structures. Internally, it uses Rigorous Coupled Wave Analysis (RCWA; also called the Fourier Modal Method (FMM)) and the S-matrix algorithm. S^4 was developed by Victor Liu of the Fan Group in the Stanford Electrical Engineering Department.

http://www.stanford.edu/group/fan/S4/#main

The S4sim is developed at Purdue University as an analysis of optical propagation in the generalized 3D structure much more quickly than many alternatives. However, the original tool is hard to use. So the goal is to make it more accessible, especially for experimentalists in PV community.This tool allowed the user to click into the parameters including the number of layers and material for each layer and to define a multi-layers structure. The original complicated coding process was totally replaced. This tool then output data for the structure, which helped making the structure clear.

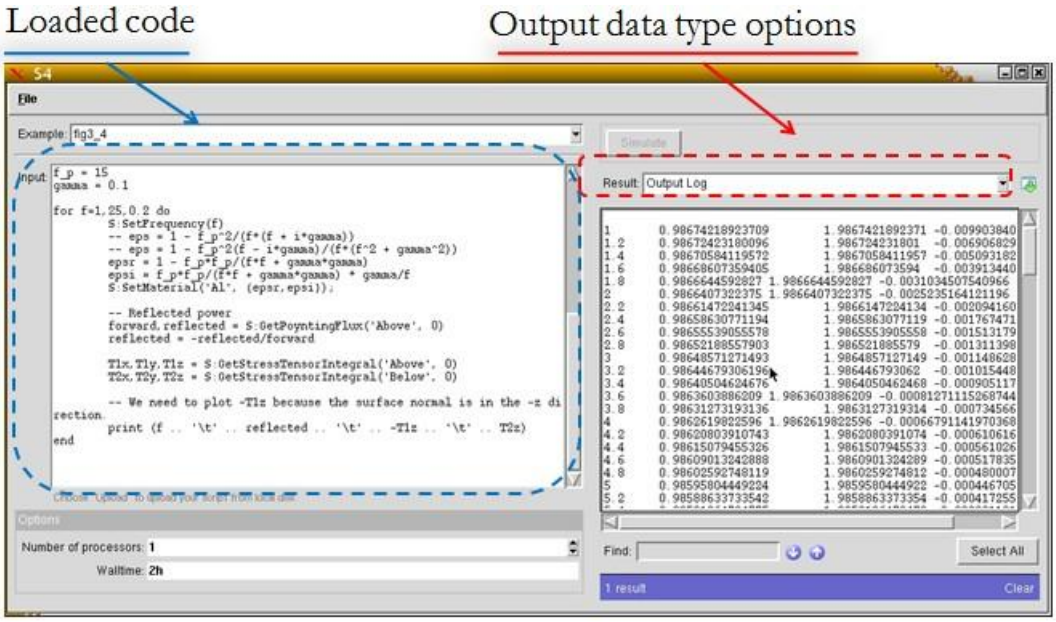
2. Front-end (GUI) Description

The front-end of S4sim is shown in figure 2.1. There is a loader to provide several examples for user to simulate some particular and important structures.



After selection, click the Simulation button to start running the program.

When simulation finished, the loaded code would be shown in the custom geometries window. User could modify or change the code in this area.



There are two different kinds of output data type shown in figure 2.2 and figure 2.3. Users could choose either numerical outputs in columns or plot with different variable curves.

Figure 2.2

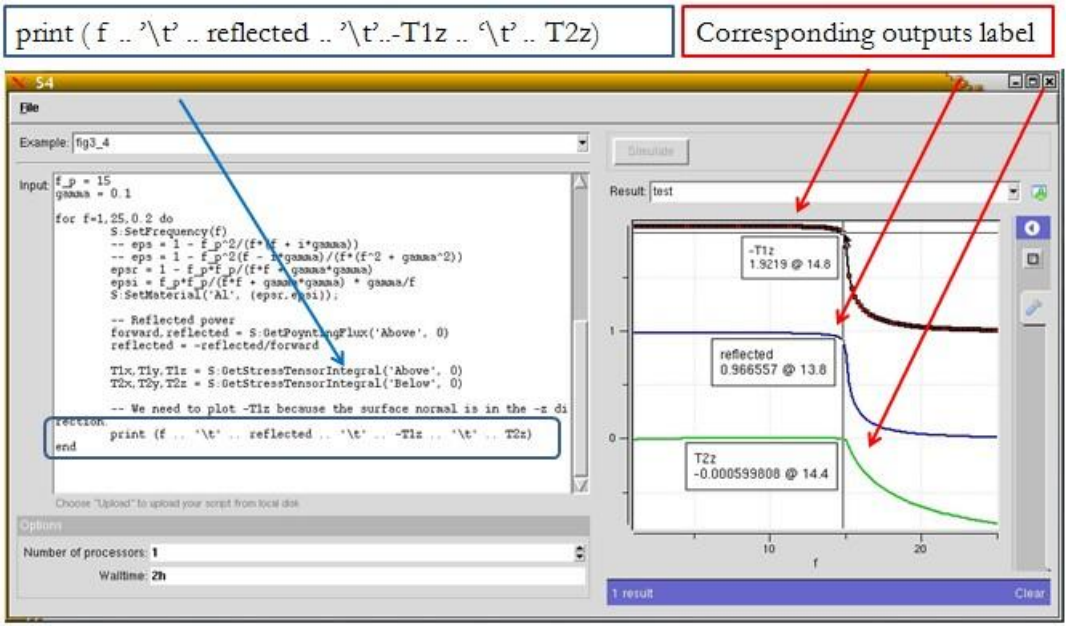


Figure 2.3

In the plot window, user could move the mouse on each curve to see the value of each point and corresponding variable name as curve's label. The label is caught automatically from the source code.

A clear button on the bottom right could be used to clear the plots and the simulation.

Citation:

Victor Liu and Shanhui Fan, "S^4: A free electromagnetic solver for layered periodic structures," *Computer Physics Communications* **183**, 2233-2244 (2012) http://dx.doi.org/10.1016/j.cpc.2012.04.026.