scgen-taper

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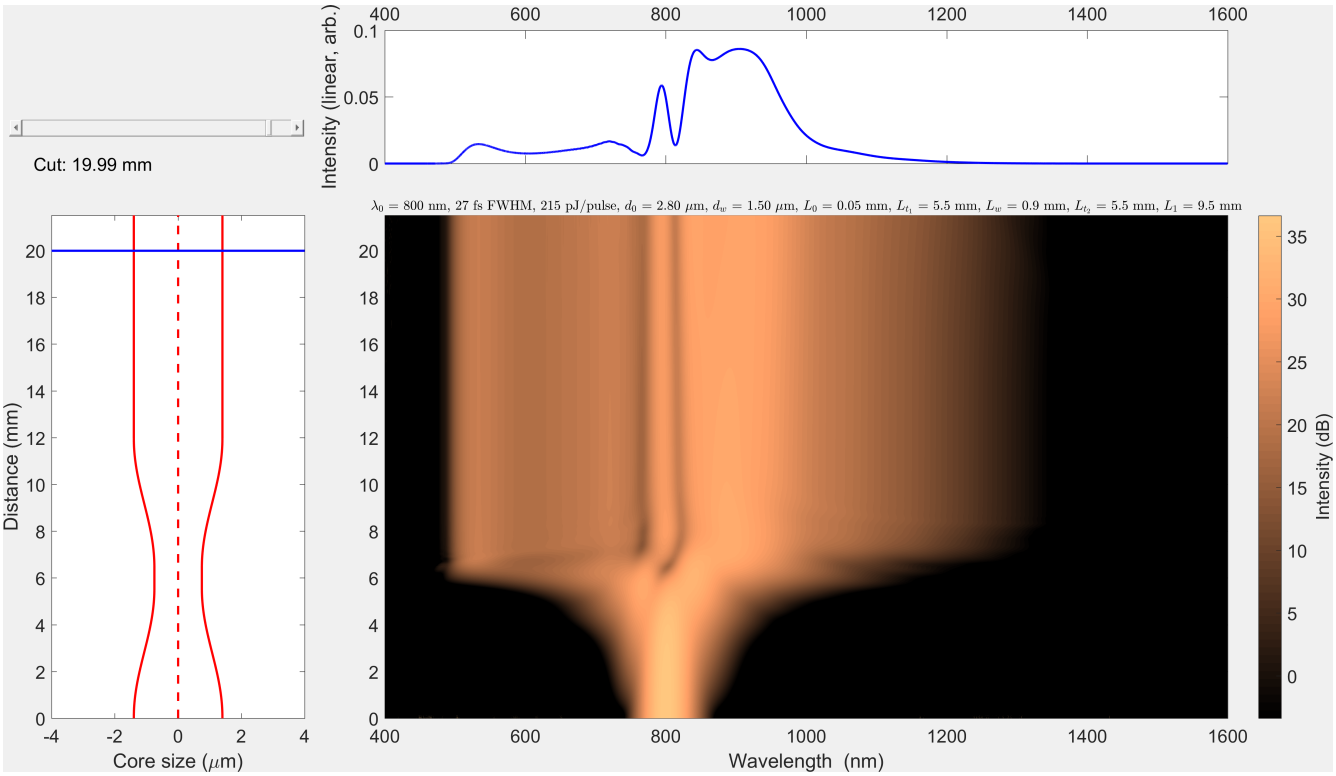

`scgen-taper` (written in MATLAB 2016b) is a free set of codes used to design dispersion-engineered photonic crystal fibers to produce flat, broadband supercontinua for astronomical applications, as described in arXiv:1807.07857. As shown above, it features a graphical user interface which allows the user to visualize fiber geometry, pulse evolution, and probe the spectra at arbitrary cuts along the fiber length. The codes are readily adapted to other applications involving longitudinally varying fiber geometries.

Overview of files and folders:

- `simulate_tapered_pcf.m` is the main script to run the simulation. If not called externally with custom configuration and parameters, this script uses defaults.
- `default_config.m` is a script that contains the default setup for the computational grid.
- `default_param.m` is a script that contains the default laser and fiber parameters.

- `prep_fiber_data.m` is a script that takes the configuration and parameters to build the necessary fiber data (dispersion operator, effective index, effective area) for the simulation. Uses data from the `fiber` folder.

- `gnlse_taper.m` is a function that solves generalized nonlinear Schrödinger equation in a tapered fiber to propagate the field forward.

- `build_fiber.m` is a function that builds a tapered fiber geometry as parametrized in Figure 1a of arXiv:1807.07857.

- `plotter_lin.m` is a visualization script that shows fiber geometry, pulse evolution in the spectral domain (pseudocolor map with log color scale) and spectral cuts (with linear y-scale, using `plot_cut_lin.m`) at arbitrary points along the fiber length. Features a slider GUI element to probe spectra. No time-domain pulse evolution shown.

- `plotter_log.m` is a visualization script that shows fiber geometry, and evolution in both the spectral and time domain. Cuts (with log y-scale, using `plot_cut_log.m`) at the output facet of the fiber are also shown in both domains. No GUI.

- `plot_ZDW.m` is a utility to overlay pre-computed zero-dispersion wavelength data on a pseudocolor map of pulse evolution in the spectral domain. Useful to see if the pulse is propagating in the anomalous or normal dispersion regime.

- `calculate_g12.m` is a utility that calculates the first-order coherence of the supercontinuum. Runs the script `simulate_tapered_pcf.m` repeatedly, with the input field seeded with random noise. Can be quite time-consuming depending on the configuration and number of runs!

- `add_shot_noise.m` seeds the input field with shot noise for the coherence calculation, as described in Appendix B of arXiv:1807.07857.

- `snapshot.png` is a screen capture of what you should see if you simply run the script `simulate_tapered_pcf.m` with default settings.

- `fiber` folder contains dispersion and effective area data computed for various core diameters of a tapered NL-2.8-850-02 fiber. Manufacturer's datasheet is also provided.

- `figures` folder contains nearly all the figures from arXiv:1807.07857 as `.fig` files or scripts to produce them (e.g. in the case of Figure 3, which is very large). Where possible, figure data is also provided as `.mat` files. Raw experimental data is also provided.

- `saved` folder contains pre-computed data such as correlation functions (which might take a while to re-generate) and zero-dispersion wavelengths.