NLSE Solver

This program solves a modified nonlinear Schrödinger Equation of the form

$$\begin{aligned}\frac{\partial A(t,z)}{\partial z} &= -\frac{i\beta_2}{2}\frac{\partial^2 A(t,z)}{\partial t^2}+\frac{\beta_3}{6}\frac{\partial^3 A(t,z)}{\partial t^3}-\frac{\alpha}{2}A(t,z)\\ &+ i\gamma\left[|A(t,z)|^2A(t,z)+\frac{i}{\omega_0}\frac{\partial(|A|^2A)}{\partial t}-T_R\frac{\partial(|A|^2)}{\partial t}A\right]\end{aligned} \tag{1}$$

using the symmetric split-step method.

Fiber Parameters
"alpha" or α is the fiber loss (in inverse meters 1/m)

"gamma" or γ is the fiber nonlinearity (in inverse Watt meters $(\mathrm{Wm})^{-1}$)

"beta_ 2" or β_2 is the fiber's second-order dispersion (in seconds squared per meter (s^2/m)

"beta_ 3" or β_3 is the fiber's third-order dispersion (in seconds cubed per meter (s^3/m)

"T_ R" provides an approximate way of incorporating the Raman response. This treatment is valid for many TelCom based pulse propagation simulations, however, fails in the case of supercontinuum generation (the code to solve that problem is not provided in this package).

"s = ω_0^{-1}" provides an approximate way to incorporate the effect of self-steepening. "s" is the parameter the user supplies in the program's interface.

Other Options
"Propagation Distance" is just the distance you wish to propagate in metes (m)

"Time Scale" is the temporal scale which the field is defined over in seconds (s). A time scale = 10 means that the field is defined over the range -10..10 seconds.

Input Field
"Shape;" our pulse shapes are defined in the following manner (relative to the entry fields in the dialog window)

$$\text{Gaussian} = \sqrt{\text{Peak Power}}\times\exp\left\{-\frac{T^2(1+i*\text{Chirp})}{2T0^2}\right\} \tag{2}$$

$$\text{Secant} = \sqrt{\text{Peak Power}}\times\text{Sech}\left(\frac{T}{T0}\right)^{1+i*\text{Chirp}} \tag{3}$$

As can be seen from the above definition of the field:

“Chirp” is dimensionless

“Width(T0)” is given in seconds (s)

“Peak Power” is given in Watts (W)

Plotting Options

The plotting options just provide users with a few of the common visualization options used to investigate propagation under the influence of the NLSE. We point out that the user is only ever able to plot the intensity of the field.

The “Input/Output Plot” plots the input (temporal or spectral) intensity along with the output (temporal or spectral) intensity

The “Waterfall Plot” provides 3D visualization of the evolution of the field during propagation. This plot is currently missing axis labels. They will be included in a future release.

The “Surface Plot” shows an intensity-to-color rendering of the field during propagation

The “Animated Plot” shows the field evolution as a movie