18/9/2011

Instruction how to run the code for calculating the noise spectrum induced by SBS in the forward propagating wave:

The main program is called ``main.m''. The other Matlab files should be put in the same directory as the main program. The names of the coefficients in the beginning of the ``main.m'' program are the same as in the manuscript:

A.David and M. Horowitz, ``Low-frequency transmitted intensity noise induced by stimulated Brillouin scattering in optical fibers,'' Optics Express, Vol. 9, 11792–11803, 2011.

The software solves the dynamic equations for modeling Brillouin scattering in fibers and its initiation from thermal noise. The equations are described with details in the manuscript.

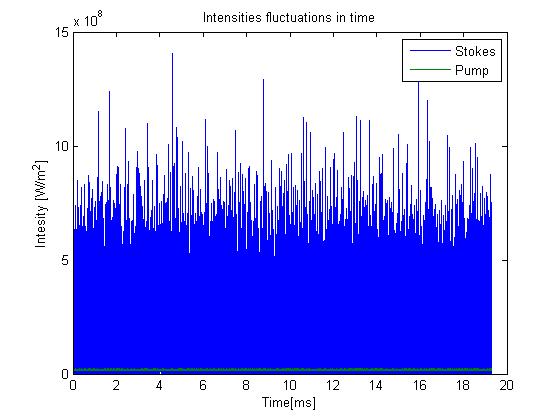
The equations are solved by using first order split-step method. Each iteration in the software corresponds to a propagating of the two counter-propagating waves by temporal step size of 4.8 ns.

In Fig. 1 the software plots the steady state optical average power along the fiber. The steady state solution is obtained by solving equation (11) I Ref.:  
  
R. B. Jenkins, R. M. Sova, and R. I. Joseph, "Steady-State Noise Analysis of  
Spontaneous and Stimulated Brillouin Scattering in Optical Fibers," IEEE J.  
Lightwave Technol. 25, 763-770 (2007).

Figure 2 gives the normalized optical power along the fiber of the stochastic wave that is compared to the steady state solution. The stochastic solution is updated each 5000 iterations. The power of the pump wave and the Stokes wave are normalized to the input power. There is a physical meaning to the solution only after about 100,000 iterations since the initial conditions, at *t=*0, correspond to a zero Brillouin wave.

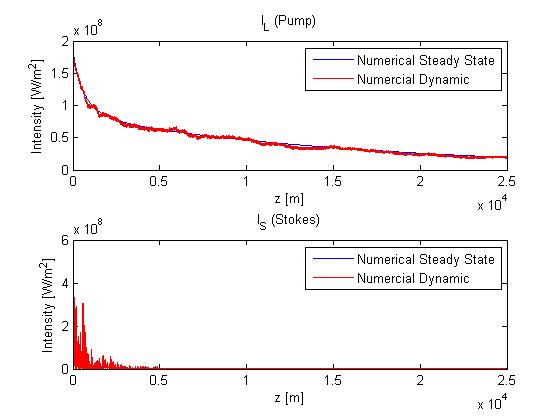
|  |  |
| --- | --- |
| Figure | Figure |

Figure 3 gives the temporal function of the optical transferred intensity (pump wave at z=L) and the reflected Brillouin intensity (Stokes at z=0).



Figure

Figure 4 gives the longitudinal intensity profile of both the pump (top figure) and Stokes wave (bottom figure) for the stochastic solution that is compared to the steady state solution.



Figure

Figures 5 and 6 give the RF spectral power density of the transmitted and the reflected waves, respectively. The figures are calculated only after a sufficient time that 500,000 iterations. This ensures that the initial conditions do not significantly change the result. Then, the software runs for another 4,000,000 iterations. In the code given the RF spectrum is calculated up to low frequencies of 50Hz and hence the number of iterations in the final stage is high – 4e6. One can, of course, change this parameter. The total runtime is few hours. In case that one needs to calculate the spectrum for powers that are around or smaller than the Brillouin threshold a reduced model that is shortly described in the manuscript can be used.

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| --- | --- |
| fig5.jpg  Figure | fig6.jpg  Figure |

   
  
The code generates Figs. 2,3,7 and 8 in the Optics Express manuscript given above.  
  
 