

M2 research project  
**Random birefringence in optic fibers**

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**Description of the proposal :**

An important source of random perturbations arising during signal propagation in optic fibers is due to the presence of birefringence, which is a difference between the group velocities of the two polarized components of the (vector) electric field. This phenomenon, usually called “PMD” (for Polarization Mode Dispersion), induces a signal broadening which has been also experimentally observed in the case of Soliton transmission in Kerr fibers, even though this broadening effect is then less important than in the case of linear propagation.

In fibers with Kerr effect, the envelope of the electric fields satisfies, for the two polarized components, a system of coupled nonlinear Schrödinger equations, containing in addition a random term that represents the difference of group velocities between the two orthogonal components of the field. Without those random perturbations, the coupled system possesses a family of soliton solutions.

The aim of the project will be to compute numerically the solutions of the coupled system, in the case where the random term is a white noise, and to deduce the influence of the noise on the evolution of the soliton parameters. The numerical study will be completed by an asymptotic study, which may allow to prove theoretically the broadening of the signal with the propagation distance.

**Location :** Centre de Mathématiques Appliquées, Ecole Polytechnique

**Requirements:** The student must be motivated by modeling problems and have some knowledge in numerical analysis; basic knowledge in probability would be appreciated, but is not compulsory.