1096-34-546 **Avner Peleg*** (apeleg@buffalo.edu), Department of Mathematics, University at Buffalo, Buffalo, NY 14260. *Large-scale particle dynamics simulations for pulse propagation in broadband optical fiber communication networks.*

We present an efficient model for simulating and analyzing propagation of optical solitons in fiber optics communication networks with a large number of frequency channels. The model consists of a system of hybrid stochastic nonlinear ODEs for the pulse parameters (amplitude, group velocity, etc.), where coupling is due to inter-pulse interaction and stochasticity is due to bit-pattern randomness. The derivation of the model is based on the method of eigenmode expansion with the eigenmodes of the linear operator $\hat{L}$, describing small perturbations about the fundamental soliton of the nonlinear Schrödinger (NLS) equation. We will discuss the main challenges in carrying out large-scale simulations with the model, including compensation of average effects, which requires analysis of N-dimensional Lotka-Volterra models. We will then present the results of the simulations for the probability density functions of pulse parameters, the equal-distance two-time correlation functions, and the error probability (the bit-error-rate). Comparison of the simulations results with predictions of a simplified stochastic mean-field ODE model will also be presented. (Received September 05, 2013)