

Simple Multimode EDF Amplifier (EDFA MM)

Basic Forward-Pumped EDFA MM

This illustrates operation of the erbium-doped multimode fiber amplifier (EDFA MM) with multimode signal (C-band) and direct pumping at 980 nm. For the pure LP01 pump, the behaviour of the LP01 and LP11a modes are considered in the C-band. The modes for pump and signals can be taken into account by setting the mode numbers (ID) in the CouplerFiberMM module (parameter CoupledModes). Table 1 demonstrates the correspondence between the numbers and the type of the modes.

The simulation schematic contains the following two fiber modules required for the multimode simulations: SolverDopedFiberMM and DopedFiberMM:

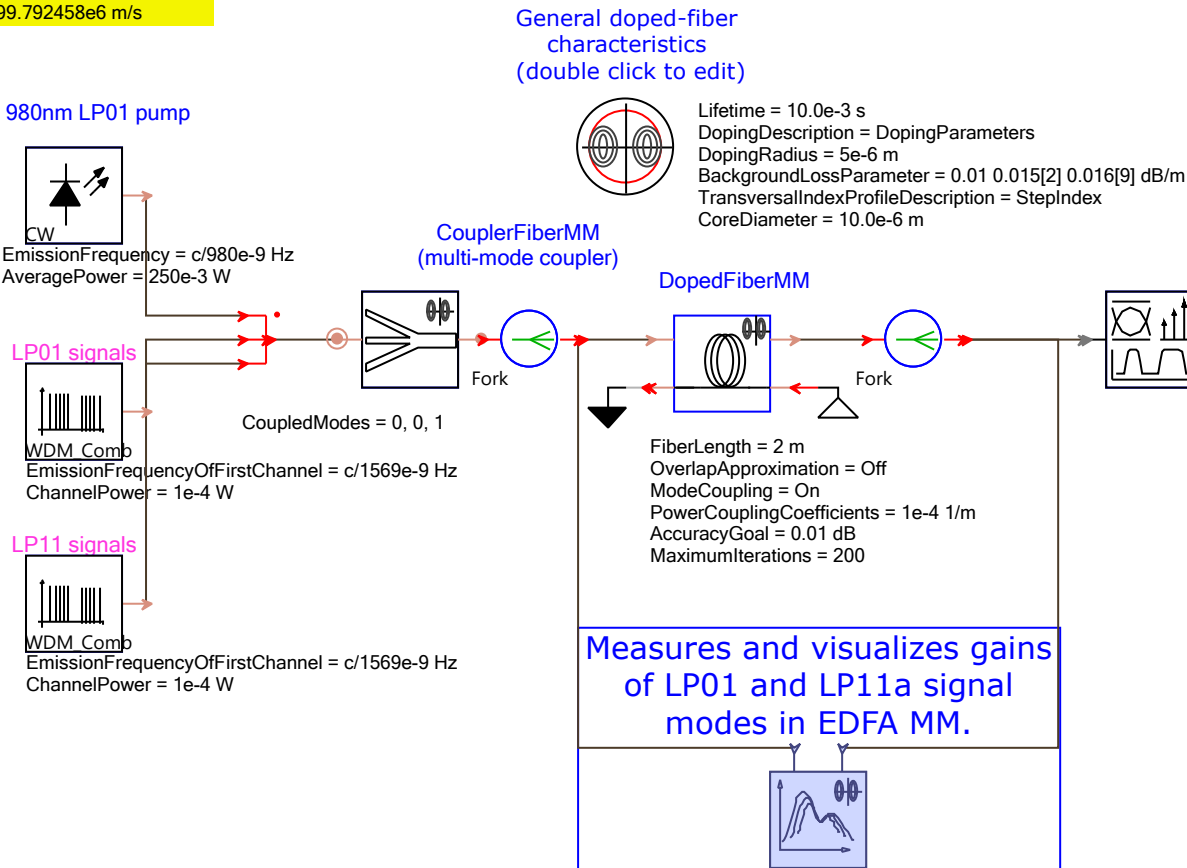
+) The fiber design and general physical characteristics (refractive index & doping profiles, the emission and absorption cross sections, the mode-dependent loss (MDL), etc.) are specified in the SolverDopedFiberMM module. This module contains an embedded mode solver that calculates the intensity mode profiles required to find the overlap with the doping profile.

+) The signal propagation problem is solved in the DopedFiberMM module. Correspondingly, the fiber length is specified in this module. The fiber design is specified by the ID of the SolverDopedFiberMM module. In the DopedFiberMM module, moreover, the ModeCoupling parameter controls whether the random coupling effects are taken into account or not. The coupling strength between the modes is moreover determined by the power-coupling coefficients. These coefficients can be directly entered into the PowerCouplingCoefficients parameter or calculated by making use the values from the FieldCouplingCoefficients, ModeCouplingCorrelationLength and ModeCouplingCorrelationFunction parameters.

Both SolverDopedFiberMM and DopedFiberMM have capabilities for visualization and/or saving to file of many physical characteristics, e.g. the calculated mode profiles, transversal and longitudinal inversion distributions, the specified index and doping profiles, overlap factors, etc. Moreover, the total number of the calculated modes as well as number of iterations and accuracy may be shown in the "Message Log" window ("Report Progress" should be activated in "Submit Simulation Job" for this).

These modules can be used to simulate and optimize both the differential modal gain (DMG) and MDL compensation in the space division multiplexing (SDM) systems.

SCHEMATIC PARAMETERS:
c = 299.792458e6 m/s



Mode number (ID)	Mode label
0	LP ₀₁
1	LP _{11a}
2	LP _{11b}
3	LP _{21a}
4	LP _{21b}
5	LP ₀₂

Table 1. Mode numbers (ID) corresponding to the type of the modes (Mode label)