Fibre LP Mode Solver and Simulator (Matlab)

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Description

This library solves the eigenvalue equation for a step-index fibre under the weakly-guided, linear polarisation approximation, generating propagation constants and other parameters, including power in core, for each of the supported LP modes. (The solution is only valid for small fibre numerical apertures with step index profiles.) Mode amplitudes and intensities can be plotted, and arbitrary input fields can be coupled into the fibre, allowing the coupling efficiency and power in each mode to be calculated. The fields can be propagated along an arbitrary length of fibre.

Functions are listed below with brief descriptions. Each function is fully documented in the .m files. See the examples for use of the various function.

Version History

Replaces LP Mode Solver Version 1.2. The mode solver has not changed, but additional functions for simulating fibres have been added.

Examples

example_general	Defines a fibre, finds LP modes, plots all LP modes and displays example amplitude and intensity plots in figures.
example_couple_beam	Generates a Gaussian input beam and couples into fibre.
example_coupling_angle	Generates plane waves at a range of angles and calculates coupling efficiency for each, comparing with geometric acceptance angle.

example_propagate_beam	Couples a field into a fibre and propagates, displays field and intensity at far end of fibre.
example_speckle_pattern	Couples a random field into a fibre, propagates to generate speckle pattern at far end.

Primary Functions

Basic Fibre Properties:

est_num_modes	Estimates the number of modes the fibre will support based on its V number.
fibre_na	Returns the fibre NA and geometric acceptance angle based on the core and cladding refractive index.

Mode Solving:

find_LP_modes	Find all LP modes of a specified fibre and light wavelength.

Mode Plotting:

plot_LP_mode_node	Generates a 2D amplitude plot of a specific mode, normalised.
plot_LP_mode_profile	Generates a radial intensity or amplitude plot of a specific mode.
plot_all_LP_modes	Plots all the LP modes found by *find_LP_modes*.
power_in_core	Returns the power in core for each mode (based on 2D plot)

Fibre Simulation:

couple_beam	Simulates coupling of an arbitrary input field into the fibre, calculating amplitude and phase (and power) in each mode.
tilted_field	Generates a plane wave at a specified angle, for use in coupling into fibre.
propagate_through_fibre	Propagates field through fibre. Field is projected onto modal basis, the phase of each mode is propagated according to its propagation constant, and the net field calculated.

Secondary Functions

calculate_LP_mismatch	Used by *find_LP_modes* to find solutions to the characteristic equation.