Static and dynamic mode instabilities in dual-core fiber amplifiers

This paper provides a detailed derivation of coupled-mode equations for thermo-optic nonlinear effects in dual-core fiber amplifiers. The equations predict both static and dynamic modal deformations depending on amplifier design. The prediction of static deformations is confirmed by nonlinear beam-propagation simulations. The dependencies of instabilities and their thresholds on launch conditions are analyzed by numerical simulations and analytical arguments. It is shown that the output stability properties are strongly dependent on the relative phase of the input in the two cores. The instability power threshold for dual-core amplifiers with strongly coupled cores are found to be lower than for a comparable single-core amplifier. However, as the core separation is increased, the dual-core amplifier threshold rapidly increases when light is amplified in the odd supermode.