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Modelling and simulation of a Distributed Feedback Erbium Ytterbium doped fiber laser

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Abstract content
   (Max 300 words)

A complete theoretical approach for modelling a Distributed feedback fiber laser using coupling mode theory is presented. The method presented emphasized on linking actual physical concepts to their mathematical expressions. In a DFB Fiber Laser, the rare earth doped fiber constitute the gain medium. Resonant feedback is provided by a single fibre Bragg grating written into the fiber gain medium.
To model the distributed feedback fiber laser, the rate equations derived from Erbium and Ytterbium ions transitions are first solved to determine the electron populations at each energy level; which is then used in the propagation equations for the pump and the laser fields. To analyse the distribution of the fields inside the DFB Fiber Laser, the well known coupled mode theory for periodic structure is used. The coupled mode equations are derived by defining and solving the modes of the fiber laser without the grating first, and then a linear combination of these modes is used as a trial solution to Maxwell equations for the structure with a grating. The derived coupled mode equation can be solved analytically or by numerical methods. A straight forward method is the numerical integrations of the coupled mode equations. However because of the complicated nature of the electromagnetic field in the DFB Fiber Laser, such a numerical integration could be very slow. In the present work the resultant coupled mode equations are solved using the fast and accurate iterative transfer matrix method .The solutions obtained allowed the simulation of the spectral response, output power, and slope efficiency of the distributed feedback fiber laser.
This model is simple, accurate and describes in a detailed manner a DFB fiber laser.

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MSc

Main supervisor (name and email)
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yes

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