Abstracts

A Method for the Calculation of the Radiation-Pattern and Mode-Conversion Properties of a Solid-State Heterojunction Laser

L. Lewin. "A Method for the Calculation of the Radiation-Pattern and Mode-Conversion Properties of a Solid-State Heterojunction Laser." 1975 Transactions on Microwave Theory and Techniques 23.7 (Jul. 1975 [T-MTT]): 576-585.

A solution of the laser fields, both inside and outside the laser, is given in terms of the mode-conversion coefficients and an integral equation for the radiation pattern. It is shown how very accurate analytic solutions can be obtained by what, at first sight, appear to be extremely crude approximations. The reason is that mode conversion is taken implicitly into account by using a multiplier, whose exact form does not appear to be very critical, as a weighting function to average two different formulas for the function representing the radiation; and with the correct form for it, all the mode-conversion and reflection coefficients can be legitimately ignored. A plane-wave formula for this multiplier is a good first approximation, and a number of existing expressions occurring in the literature are obtained in this way. It is also shown rigorously that the results of an earlier obliquity-factor analysis apply. Further refinements are introduced to allow for higher order discrete modes, and good approximate analytic forms for the mode-reflection and conversion coefficients are obtained. A check with a rather extreme example shows excellent agreement with Ikegami's numerical computation for the dominant-mode reflection at the laser-air interface. The methods of this paper are applicable to general laser structures of cylindrical geometry with either continuous or discontinuous variations in refractive index. Very accurate numerical solutions should be obtainable after only one iteration of the integral equation, starting with the reflection-modified form of Hockham's formula as initiating function.

❑ Return to main document.