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구조변화가 심한 이종 도파로 경계면에서의 반사율

Determination of Reflectance at Abrupt Waveguide Interfaces with Large Structural Difference

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A way to find accurate estimation of reflectance or transmittance at a dielectric interface, such as a laser facet, or fiber end would be of interest to scientists and engineers of the fields. Classical paper on this subject deals with this problem by finding eigensolutions of the wave equation at both sides of the interface and imposing appropriate boundary conditions[1]. However, this method can not be extended to complicated structures. Other frequently used method is approximating eigensolutions by Gaussian beam and the quantity of interest is obtained using Gaussian optics and mode matching[3]. This method is still subject to the same limitation, not to mention that the laser mode is generally not a gaussian and this method can not take into account the effect of multiple reflections.

Previously, we have presented a new method of finding transmittance or more importantly reflectance at abrupt interfaces of a complicated waveguide structure within the limit of scalar wave approximation[3]. This approach is based on a formal solution of finite differenced wave equation in a dielectric media[4].

However, there was a practical difficulty in certain kind of problems. For example, an efficient laser-fiber butt coupling is technically quite important. Because of the huge difference in the structure, it is almost impossible to model this by our method. To overcome this limitation, a non-uniform differencing step has been employed and the diagonal matrix[5] has been used to transform the characteristic matrix into a symmetric one. This algorithm has been successfully implemented and new insight has been gained. In the talk, several problems such as fiber-to-fiber, etched semiconductor mirror, and laser-to-fiber coupling problem will be discussed and the effect of multiple reflections and diffraction will also be analyzed.

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