Abstracts

Cutoff Phenomena for Guided Waves in Moving Media

This paper treats the propagation of electromagnetic waves in the interior of a waveguide that is filled with a moving medium. The medium is assumed to be homogeneous, isotropic, and lossless, and to move with a constant velocity along the axis of the waveguide. The Maxwell-Minkowski equations for the electromagnetic fields are solved by means of a pair of vector potential functions similar to those frequently used for stationary media. The fields inside the waveguide are derived for both rectangular and cylindrical waveguides. The well-known cutoff phenomenon for a waveguide is found to be modified in an interesting way when the medium inside the waveguide is moving The results show that for a slowly moving medium (a medium for which n Beta<1, where n is the index of refraction and Beta is the velocity of the medium divided by the velocity of light in vacuum, there are two critical frequencies, separating three frequency ranges in each of which there is a different type of propogation. For a high-speed medium (n Beta<1), it is found that there is no cutoff phenomenon at all, although there is one critical frequency separating two frequency ranges in which the propagation is different.

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