

Section B. Electricity and Magnetism

1. Electromagnetic radiation in TEM mode propagates along a coaxial waveguide consisting of two concentric, right circular cylinders of infinite conductivity. The radius of the inner conductor is a , and of the inner surface of the outer conductor is b . The region of the conductors corresponding to negative values of z (the symmetry axis of the cylinders) is vacuum. The region at positive z is filled with a uniform lossless dielectric, (dielectric constant ϵ). The wave is propagating only in the positive direction in the dielectric, while there are incident and reflected waves in the vacuum region. Assume the incident wave has peak electric field E_o at the surface of the inner conductor, and oscillates with frequency ω .
 - a) In terms of E_o , a , b , and any necessary constants for your system of units, find the time-averaged power of the incident wave propagating in the vacuum side of the cable.
 - b) Calculate the electric and magnetic fields for the reflected, and transmitted waves. Specify the amplitudes, and space and time dependence.
 - c) Find the average force per unit area on the dielectric interface at $z = 0$.

