

Surface Wave Propagation Along a Metamaterial Cylindrical Guide

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Abstract

The dispersion relations for metamaterial cylindrical guides have been found and their Brillouin diagrams have been drawn for different parameters of the guides. It has been found that the transverse propagation coefficient of the first TM_z mode and of the first TE_z mode could be either real or imaginary. The longitudinal propagation coefficient of the first TM_z mode starts at zero frequency and ends at a frequency where it is equal to the wave-number of the surrounding dielectric medium, while the longitudinal propagation coefficient of the first TE_z mode starts at this same frequency and grows afterwards indefinitely. The first hybrid mode of order one as well as subsequent modes have also been studied. It has been found that for the first TM_z and TE_z modes, the group velocity is almost constant whether the transverse propagation coefficient is real or imaginary. Moreover, interesting coupling effects could be obtained by using adjacent metamaterial and dielectric cylindrical guides.