Wiener-Hopf Analysis of TM Wave Reflection by a Step Discontinuity on the Junction of Two Coaxial Waveguides with Perfectly Conducting and Impedance Walls

G. Çınar¹, S. Akşimşek², B. Nilsson³, S. Nordebo³, and Ö. Yanaz Çınar¹

¹Eskişehir Osmangazi University, Turkey
²Istanbul Kültür University, Turkey
³Linnaeus University, Sweden

Abstract—In this study, the reflection of TM waves by a junction of a perfectly conducting coaxial waveguide with a step discontinuity on its inner wall and an impedance coaxial waveguide is analyzed rigorously by Wiener-Hopf technique (see Fig. 1(a)). The problem represents two main scattering mechanisms which occur in the measurement setup for the experiments performed on a 80 km long High Voltage Direct Current (HVDC) power cable in a factory and on the 250 km long Baltic HVDC power cable [1]. The effect of the step discontinuity alone on the scattered fields has been studied by the authors recently in [2, 3].

In order to determine the reflection coefficient for this problem, one first needs to analyze TM wave propagation along the waveguide junctions shown in Fig. 1(b) and Fig. 1(c). The scattering coefficients obtained by solving these two problems can then be taken into account to apply the generalized scattering matrix method which eventually provide the reflection coefficient related to the original problem.

![Figure 1](image1.png)

The scattering coefficients for the problems given in Fig. 1(b) and Fig. 1(c) are obtained simply by extending the formulations described in [3] and [4] (which are done for only TEM modes) to the cases of TM wave incidences. In addition to these, the problem in Fig. 1(b) is also solved when the TM wave is incident from the opposite direction. With the help of these scattering coefficients and the generalized scattering matrix method, the reflection coefficient for the original problem is determined. The numerical results are compared to the ones obtained by applying mode-matching technique directly to the problem shown in Fig. 1(a).

REFERENCES