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Asymptotics in a Complex Frequency Domain and GPR Problems

Abstract

A ground penetrating radar system consists of a transmitter located over the surface and a receiver located on the surface. A pulsed electromagnetic field is transmitted. The receiver measures the horizontal components of both the electric and magnetic fields. The Ground Penetrating Radars problem is in recovering electrical characteristics of the medium from the readings of the receiver. This problem is ill-posed and cannot be solved precisely because of insufficiency of data. We will discuss approximate solutions of the problem based on asymptotic solutions of Maxwell's equations in the complex frequency domain. To establish the limits of applicability of the method, we derive error estimates and show that the method is numerically efficient if thickness of layers is not less than some resolution threshold (which is of the order of wave length). The efficiency of the method is illustrated by numerical testing.