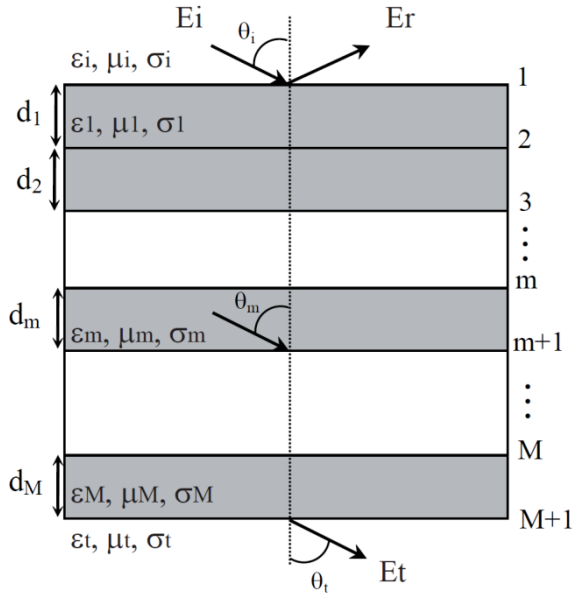
Project

Reflection and transmission coefficients of a multilayer structure and its homogenisation

Suppose that a TE or TM polarised plane wave is incident to a multilayer structure composed of M different materials. Each layer is identified by its electrical properties (ε_m, μ_m, σ_m) as well as its thickness (d_m). The permittivity of the layer can be complex ($\varepsilon_m = \varepsilon'_m - j\,\varepsilon''_m$). The medium of incident wave (medium i) and that of the transmitted wave (medium t) are semi-infinite and are characterised respectively by (ε_i, μ_i, σ_i) and (ε_t, μ_t, σ_t). The following figure summarises the geometry of the multilayer structure.



Part 1: Reflection and transmission coefficients

Develop a computer code (e.g. with Matlab) which accepts as input the following parameters:

- The wave polarisation
- The number of layers
- The thickness of each layer
- The electrical properties of each layer
- The electrical properties of medium i and medium t

and which gives as output the following results:

- The total complex reflection coefficient in medium i as a function of the incidence angle.
- The total complex transmission coefficient in medium t as a function of the incidence angle.

Part 2: Homogenisation

For a non-magnetic multilayer structure ($\mu_m = \mu_0$), we want to find an equivalent semi-infinite homogeneous medium which replaces the multilayer structure for the reflection problem. This equivalent medium which is characterised by its complex permittivity (ε_{eq}) replaces the M layers of the multilayer structure as well as the semi-infinite medium t and is supposed to give the same reflection coefficient as the original problem in medium i. Develop a function in your computer code which according to the polarisation and the incidence angle calculates the permittivity of the equivalent homogenised medium (ε_{eq}).

Practical information :

- The report should be concise but complete: introduction, theoretical development, figures and curves with legends and associated comments, conclusion and references.
- The computer code should be executable.
- The project is to be ăŜyű via e-Ɣl·ƛſ in a single .zip file (pdf file of the report + computer code files).
- The due date is ομπμηπηλμф.
- Plagiarism is prohibited and will be penalised.