The work flow for the computation of the S-parameters has been summarized in Fig. A.1 using the nomenclature from [1]. To illustrate how to use the Birefringent Thin Films (BTF) toolbox, a simple example is shown in the following. It consists of a bilayer stack of $t_i$ thick birefringent media with extraordinary and ordinary indexes of refraction $n_{xx}^i$ and $n_{yy}^i$, respectively, where $i$ indexes the layers. The input (cover) and output (substrate) media are vacuum, and the layers are rotated an angle $\beta_i$ about the $z$-axis.
% Material's definition
cover = [1 1 1 0 0 0 inf]';
substrate = [1 1 1 0 0 0 inf]';
layer1 = [nyy1 nxx1 nyy1 beta1 0 0 t1/lambda]';
layer2 = [nyy2 nxx2 nyy2 beta2 0 0 t2/lambda]';
stack = [layer2, layer1]';

% Matrices' calculation
Fc = fmt(cover, 0); % field matrix of the cover
Fs = fmt(substrate, 0); % field matrix of the substrate
M = cmat(stack, 0); % characteristic matrix of the stack
A = smat(Fc, M, Fs); % system matrix

The resulting system matrix $\hat{A}$ directly relates input $\vec{E}_c$ and output fields $\vec{E}_s$ of the form $\vec{E} = [E_x^+, E_x^-, E_y^+, E_y^-]^T$ via $\vec{E}_c = \hat{A}\vec{E}_s$. Since the structure is bounded between semi-infinite media (free-space), forward and backward waves at the input correspond to reflected and incident waves $\vec{E}_c = [E_x^+, E_x^-, E_y^+, E_y^-]^T$, whilst only transmitted waves exist at the output $\vec{E}_c = [E_x^t, E_y^t, 0]^T$. Hence, the reflected and transmitted fields can be obtained as a function of those at the input by

\[ \vec{E}_c = \hat{A}\vec{E}_s \]
\[
E_x^r = \frac{(A_{21}A_{33} - A_{23}A_{31})E_x^i + (A_{11}A_{23} - A_{13}A_{21})E_y^i}{A_{11}A_{33} - A_{13}A_{31}}, \quad (A.1)
\]
\[
E_y^r = \frac{(A_{33}A_{41} - A_{31}A_{43})E_x^i + (A_{11}A_{43} - A_{13}A_{41})E_y^i}{A_{11}A_{33} - A_{13}A_{31}}, \quad (A.2)
\]
\[
E_x^t = \frac{A_{33}E_x^i - A_{11}E_y^i}{A_{13}A_{33} - A_{13}A_{31}}, \quad (A.3)
\]
\[
E_y^t = \frac{-A_{31}E_x^i + A_{11}E_y^i}{A_{11}A_{33} - A_{13}A_{31}}. \quad (A.4)
\]

From these, the four reflection coefficients read

\[
r_{xx} = \frac{E_x^r}{E_x^i}, \quad (A.5)
\]
\[
r_{xy} = \frac{E_y^r}{E_y^i}, \quad (A.6)
\]
\[
r_{yx} = \frac{E_x^r}{E_x^i}, \quad (A.7)
\]
\[
r_{yy} = \frac{E_y^r}{E_y^i}. \quad (A.8)
\]

and, similarly, the four transmission coefficients are

\[
t_{xx} = \frac{E_x^t}{E_x^i}, \quad (A.9)
\]
\[
t_{xy} = \frac{E_y^t}{E_y^i}, \quad (A.10)
\]
\[
t_{yx} = \frac{E_y^t}{E_x^i}, \quad (A.11)
\]
\[
t_{yy} = \frac{E_y^t}{E_y^i}. \quad (A.12)
\]

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