Subject: L4 Project: Detailed query before today's meeting?
From:
Date: 15/11/2012 06:58
To:

Hi,

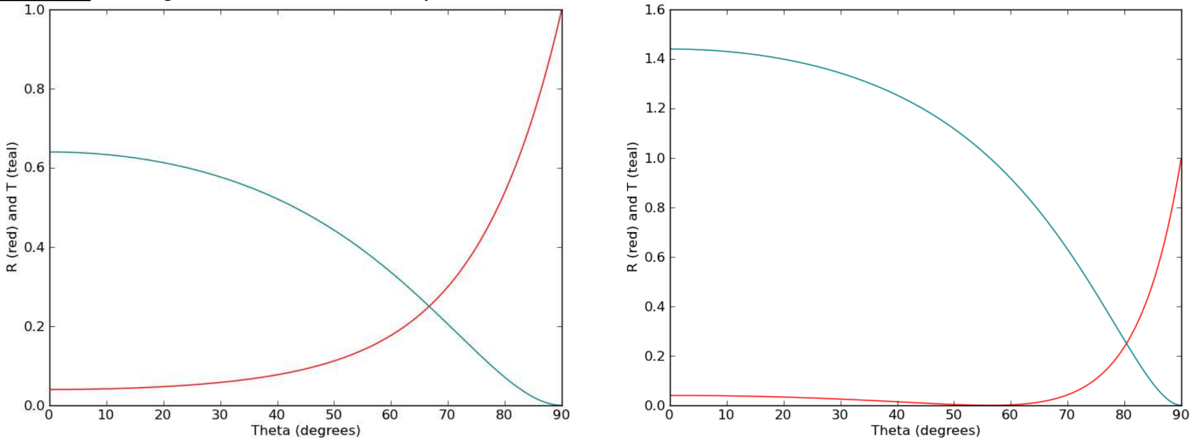
Sorry I wasn't able to see you again before 3 yesterday, I hit on an interesting problem that warranted a fair bit of investigation. Also, weekly problems.

Below are graphs for the test cases you requested. I'm sure you'll notice that for the single-interface arrangements, the reflectivity behaves, while the transmittivity does some *crazy* shit. Strangely, for arrangements with additional (different) layers, sanity seemingly returns.

Attached is a PDF in which I manually calculate R and T for some of these erroneous cases, and attempt to convince you that the error does not lie in my program, but rather in the transfer-matrix method itself.

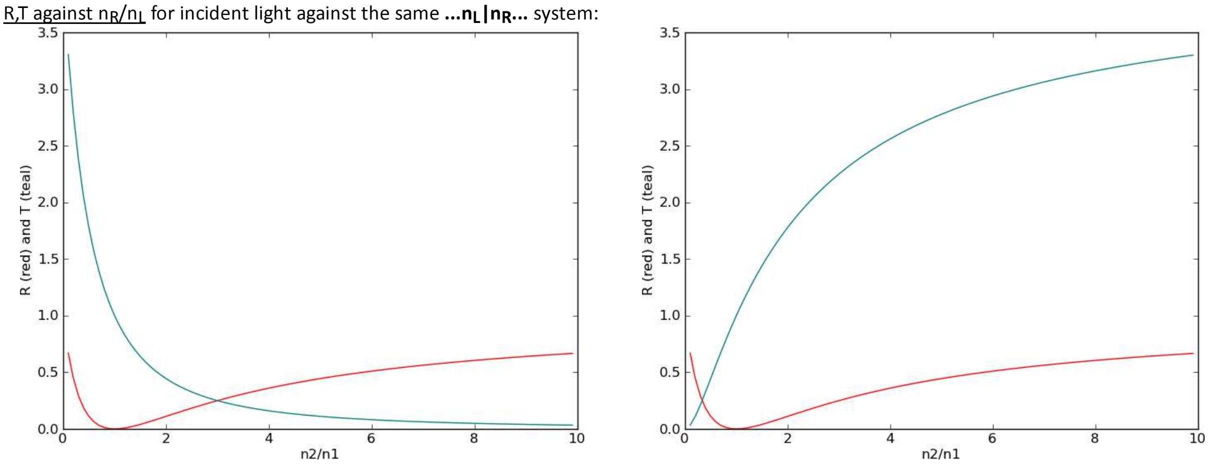
Graphs for *TE*-polarised light on the LEFT; graphs for *TM*-polarised light on the RIGHT:

1) R,T against θ for a single interface at x=0, i.e. **...n_L=1|n_R=1.5...** at λ=1550nm:



For TE, **R+T≠1**, and for TM **T>1** for $\theta<\theta_B$. R seems to function as expected (correctly matching the result of Fresnel's equations), with TE- and TM- agreeing for θ=0, and giving the correct value of Brewster's angle θ_B=56.3°. In the attached PDF I calculate R and T by hand at θ=0 for each polarisation using the transfer-matrix method, which bafflingly agree with the output of my code.

2) R,T against n_R/n_L for incident light against the same **...n_L|n_R...** system:



As before, R appears to function correctly, agreeing with the results of Fresnel's equations; with R=0 or T=1 occurring when $n_L=n_R$, but with T exploding for the ratio either less than or greater than 1 for the TE- and TM- polarisations respectively. In the attached PDF I calculate R and T by hand, at n_R/n_L=0.5 for TE- and at 2 for TM-, which also agree with the output of my code.

3) R,T against λ,E(eV) for incident light against a **(λ=1550nm)/4** Bragg stack **...air|n=2|n=4|...|n=4|n=2|air...** with a λ/2 defect in the centre n=4 layer: