Reflection from N scatterers

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We consider light reflection from a periodic structure containing N unit cells, see Fig. 1. The transfer matrix through 1 unit cell is given be

$$T = \frac{1}{t_1} \begin{pmatrix} t_1^2 - r_1^2 & r_1 \\ -r_1 & 1 \end{pmatrix} . \tag{1}$$

Goal: Calculation reflection coefficients r_N and t_N for the structure. Express them via r_1, t_1 and the eigenvalues of the transfer matrix $\exp(\pm \mathrm{i} K)$.

Answer:

$$r_N = \frac{r_1 \sin(NK)}{\sin(NK) - t_1 \sin[(N-1)K]} \, , t_N = \frac{t_1 \sin K}{\sin(NK) - t_1 \sin[(N-1)K]} \, , \tag{2}$$

Hint: The solution can be found e.g. in (Ivchenko *et al.*, 1994) and (Ivchenko, 2005), see also (Yariv and Yeh, 2002).

References

Ivchenko, E. L., 2005, *Optical Spectroscopy of Semiconductor Nanostructures* (Alpha Science International, Harrow, UK).

Ivchenko, E. L., A. I. Nesvizhskii, and S. Jorda, 1994, Phys. Solid State **36**, 1156.

Yariv, A., and P. Yeh, 2002, *Optical waves in crystals: propagation and control of laser radiation* (Wiley, New York).

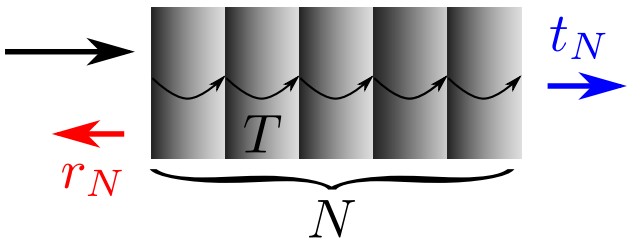

FIG. 1 Schematics of light reflection and transmission from a structure with N scatterers.