14. Kinematical Diffraction

Problems

14.1. Consider a thin foil consisting of two parallel sections, each having thickness w, with a gap separating them in the middle (parallel to the plane of the foil), such that the center-to-center distance between the sections is d. For some reflection with structure factor $F_{\mathbf{g}}$, the excitation error is s. The shape function for each ($\pm$) is

$$L\pm(z)=\begin{cases}1, & \dfrac{\pm d}{2}-\dfrac{w}{2}\le z\le\dfrac{\pm d}{2}+\dfrac{w}{2}\\ 0, & \text{otherwise}\end{cases}$$

The Fourier transforms are

$$L_{\pm}(s)=w\cdot\operatorname{sinc}(\pi sw)\cdot e^{\mp\pi isd}$$

The kinematical diffracted amplitude from each slab is

$$\Psi_{\mathbf{g}\pm}=\frac{i\lambda\cdot F_{\mathbf{g}}}{v}\cdot L_{\pm}(s)$$

Find expressions for

a) The total diffracted amplitude $\Psi_{\mathbf{g}}=\Psi_{\mathbf{g}+}+\Psi_{\mathbf{g}-}$

b) The diffracted intensity $I_{\mathbf{g}}=|\Psi_{\mathbf{g}}|^2$