The Four Complicated Integral Formulas

- "Huygens-Fresnel diffraction formula"

$$E(x,y,z) = -\frac{i}{\lambda} \iint_{\text{aperture}} E(x',y',0)\frac{e^{ikR}}{R}dx'dy' \qquad (10.1)$$

- "The Fresnel-Kirchhoff diffraction formula"

$$E(x,y,z) = -\frac{i}{\lambda} \iint_{\text{aperture}} E(x',y',z=0)\frac{e^{ikR}}{R}\left[\frac{1+\cos(\mathbf{R},\hat{\mathbf{z}})}{2}\right]dx'dy' \qquad (10.10)$$

- "The Fresnel approximation"

$$E(x,y,z) \cong -\frac{ie^{ikz}e^{i\frac{k}{2z}(x^2+y^2)}}{\lambda z} \iint_{\text{aperture}} E(x',y',0)\,e^{i\frac{k}{2z}(x'^2+y'^2)}e^{-i\frac{k}{z}(xx'+yy')}dx'dy' \qquad (10.13)$$

- "The Fraunhofer approximation"

$$E(x,y,z) \cong -\frac{ie^{ikz}e^{i\frac{k}{2z}(x^2+y^2)}}{\lambda z} \iint_{\text{aperture}} E(x',y',0)\,e^{-i\frac{k}{z}(xx'+yy')}dx'dy' \qquad (10.19)$$