6.632 Solution to Problem Set 6

Solution P6.1

(a) In xy plane, $u = kd\cos\phi$, $|F(u)| = |\frac{\sin(2u)}{\sin(u/2)}|$.
In yz plane, $u = 0$, $|F(u)| = 4$.

(b) $F = (1 + e^{-ikd\sin\theta\cos\phi})(1 + e^{ikd\cos\theta})$.
In xy plane, $\theta = \pi/2$, $u = kd\cos\phi$, $|F(u)| = 2|\frac{\sin(u)}{\sin(u/2)}|$.
In yz plane, $\phi = \pi/2$, $u = kd\cos\theta$, $|F(u)| = 2|\frac{\sin(u)}{\sin(u/2)}|$.

(c) $F = (1 + e^{-ikd\sin\theta\cos\phi})(1 + e^{-i2kd\sin\theta\cos\phi - ikd\cos\phi})$.
In xy plane, $\theta = \pi/2$, $u = kd\cos\phi$, $|F(u)| = |\frac{\sin(2u)}{\sin(u/2)}|$.
In yz plane, $\phi = \pi/2$, $u = kd\cos\theta$, $|F(u)| = 2|\frac{\sin(u)}{\sin(u/2)}|$.

(d) $F = (1 + e^{-ikd\sin\theta\cos\phi})^2$.
In xy plane, $\theta = \pi/2$, $u = kd\cos\phi$, $|F(u)| = |\frac{\sin(u)}{\sin(u/2)}|^2$.
In yz plane, $\phi = \pi/2$, $|F(u)| = 4$.