1.3.6 Evaluate the closed-surface integral of the vector $\mathbf{A} = xyz\mathbf{u_x} + xyz\mathbf{u_y} + xyz\mathbf{u_z}$ over the cubical surface shown in Problem 1.3.5. *Note: Diagram not shown.*

The cube has side length 2, and one of its corners is at the origin.

$$\begin{aligned}
\oint \mathbf{A} \bullet \mathbf{ds} &= \int_{z=0}^{2}\int_{y=0}^{2} (xyz\mathbf{u_x} + xyz\mathbf{u_y} + xyz\mathbf{u_z}) \bullet (\mathrm{d}y\mathrm{d}z\mathbf{u_x}) \\
&+ \int_{z=0}^{2}\int_{y=0}^{2} (xyz\mathbf{u_x} + xyz\mathbf{u_y} + xyz\mathbf{u_z}) \bullet (\mathrm{d}y\mathrm{d}z(-\mathbf{u_x})) \\
&+ \int_{z=0}^{2}\int_{x=0}^{2} (xyz\mathbf{u_x} + xyz\mathbf{u_y} + xyz\mathbf{u_z}) \bullet (\mathrm{d}x\mathrm{d}z\mathbf{u_y}) \\
&+ \int_{z=0}^{2}\int_{x=0}^{2} (xyz\mathbf{u_x} + xyz\mathbf{u_y} + xyz\mathbf{u_z}) \bullet (\mathrm{d}x\mathrm{d}z(-\mathbf{u_y})) \\
&+ \int_{y=0}^{2}\int_{x=0}^{2} (xyz\mathbf{u_x} + xyz\mathbf{u_y} + xyz\mathbf{u_z}) \bullet (\mathrm{d}x\mathrm{d}y\mathbf{u_z}) \\
&+ \int_{y=0}^{2}\int_{x=0}^{2} (xyz\mathbf{u_x} + xyz\mathbf{u_y} + xyz\mathbf{u_z}) \bullet (\mathrm{d}x\mathrm{d}y(-\mathbf{u_z})) \\
&= \int_{z=0}^{2}\int_{y=0}^{2} xyz\mathrm{d}y\mathrm{d}z - \int_{z=0}^{2}\int_{y=0}^{2} xyz\mathrm{d}y\mathrm{d}z \\
&+ \int_{z=0}^{2}\int_{x=0}^{2} xyz\mathrm{d}x\mathrm{d}z - \int_{z=0}^{2}\int_{x=0}^{2} xyz\mathrm{d}x\mathrm{d}z \\
&+ \int_{y=0}^{2}\int_{x=0}^{2} xyz\mathrm{d}x\mathrm{d}y - \int_{y=0}^{2}\int_{x=0}^{2} xyz\mathrm{d}x\mathrm{d}y \\
&= 0
\end{aligned}$$