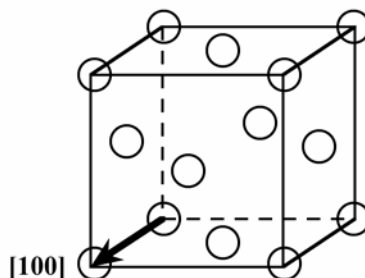


Linear and Planar Densities

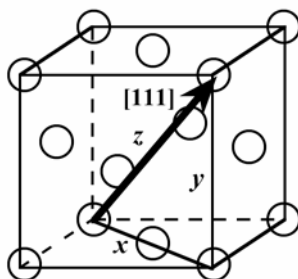
3.51 (a) In the figure below is shown a $[100]$ direction within an FCC unit cell.



For this $[100]$ direction there is one atom at each of the two unit cell corners, and, thus, there is the equivalent of 1 atom that is centered on the direction vector. The length of this direction vector is just the unit cell edge length, $2R\sqrt{2}$ (Equation 3.1). Therefore, the expression for the linear density of this plane is

$$\begin{aligned} LD_{100} &= \frac{\text{number of atoms centered on } [100] \text{ direction vector}}{\text{length of } [100] \text{ direction vector}} \\ &= \frac{1 \text{ atom}}{2R\sqrt{2}} = \frac{1}{2R\sqrt{2}} \end{aligned}$$

An FCC unit cell within which is drawn a $[111]$ direction is shown below.



For this $[111]$ direction, the vector shown passes through only the centers of the single atom at each of its ends, and, thus, there is the equivalence of 1 atom that is centered on the direction vector. The length of this direction vector is denoted by z in this figure, which is equal to

$$z = \sqrt{x^2 + y^2}$$