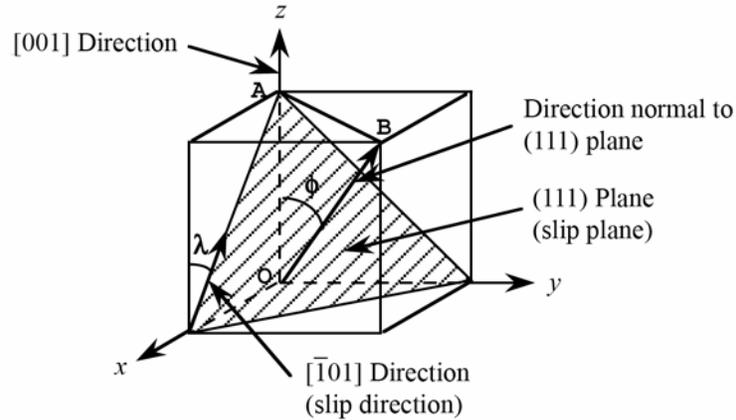


7.14 This problem asks that we compute the critical resolved shear stress for nickel. In order to do this, we must employ Equation 7.4, but first it is necessary to solve for the angles  $\lambda$  and  $\phi$  which are shown in the sketch below.



The angle  $\lambda$  is the angle between the tensile axis—i.e., along the [001] direction—and the slip direction—i.e.,  $[\bar{1}01]$ . The angle  $\lambda$  may be determined using Equation 7.6 as

$$\lambda = \cos^{-1} \left[ \frac{u_1 u_2 + v_1 v_2 + w_1 w_2}{\sqrt{(u_1^2 + v_1^2 + w_1^2)(u_2^2 + v_2^2 + w_2^2)}} \right]$$

where (for [001])  $u_1 = 0$ ,  $v_1 = 0$ ,  $w_1 = 1$ , and (for  $[\bar{1}01]$ )  $u_2 = -1$ ,  $v_2 = 0$ ,  $w_2 = 1$ . Therefore,  $\lambda$  is equal to

$$\begin{aligned} \lambda &= \cos^{-1} \left[ \frac{(0)(-1) + (0)(0) + (1)(1)}{\sqrt{[(0)^2 + (0)^2 + (1)^2][(-1)^2 + (0)^2 + (1)^2]}} \right] \\ &= \cos^{-1} \left( \frac{1}{\sqrt{2}} \right) = 45^\circ \end{aligned}$$

Furthermore,  $\phi$  is the angle between the tensile axis—the [001] direction—and the normal to the slip plane—i.e., the (111) plane; for this case this normal is along a [111] direction. Therefore, again using Equation 7.6