

8.53 If the zigzag angle θ' is 25° for the TE_{10} mode, what would it be for the TE_{20} mode?

Solution: For TE_{10} mode,

$$\theta'_{10} = \tan^{-1} \left[\frac{1}{\sqrt{(f/f_{10})^2 - 1}} \right].$$

For $\theta'_{10} = 25^\circ$, it follows that

$$\frac{f}{f_{10}} = 2.366.$$

For TE_{20} ,

$$f_{20} = 2f_{10}.$$

Hence,

$$\frac{f}{f_{20}} = \frac{f}{2f_{10}} = \frac{2.366}{2} = 1.183.$$

Hence,

$$\begin{aligned} \theta'_{20} &= \tan^{-1} \left[\frac{1}{\sqrt{(f/f_{20})^2 - 1}} \right] \\ &= \tan^{-1} \left[\frac{1}{\sqrt{(1.183)^2 - 1}} \right] = 57.7^\circ. \end{aligned}$$
