

**8.45** If the zigzag angle  $\theta'$  is  $20^\circ$  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  $\theta'_{10} = 20^\circ$ , it follows that

$$\frac{f}{f_{10}} = 2.92.$$

For  $TE_{20}$ ,

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

Hence,

$$\frac{f}{f_{20}} = \frac{f}{2f_{10}} = \frac{2.92}{2} = 1.46.$$

Hence,

$$\begin{aligned} \theta'_{20} &= \tan^{-1} \left[ \frac{1}{\sqrt{(f/f_{20})^2 - 1}} \right] \\ &= \tan^{-1} \left[ \frac{1}{\sqrt{(1.46)^2 - 1}} \right] = 43.16^\circ. \end{aligned}$$

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