5.36 Show that if no surface current densities exist at the parallel interfaces shown in P5.36, the relationship between θ_4 and θ_1 is independent of μ_2.

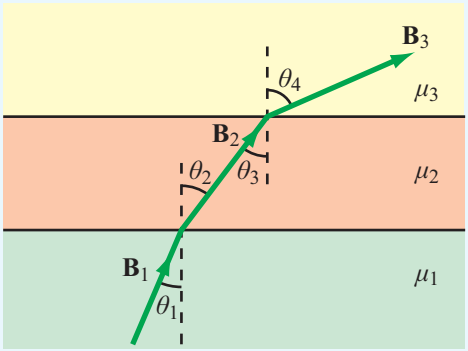

Figure P5.36 Three magnetic media with parallel interfaces (Problem 5.36).

Solution:

$$\tan\theta_1 = \frac{B_{1t}}{B_{1n}},$$

and

$$\tan\theta_2 = \frac{B_{2t}}{B_{2n}}.$$

But $B_{2n} = B_{1n}$ and $\dfrac{B_{2t}}{\mu_2} = \dfrac{B_{1t}}{\mu_1}$. Hence,

$$\tan\theta_2 = \frac{B_{1t}}{B_{1n}}\frac{\mu_2}{\mu_1} = \frac{\mu_2}{\mu_1}\tan\theta_1.$$

We note that $\theta_2 = \theta_3$ and

$$\tan\theta_4 = \frac{\mu_3}{\mu_2}\tan\theta_3 = \frac{\mu_3}{\mu_2}\tan\theta_2 = \frac{\mu_3}{\mu_2}\frac{\mu_2}{\mu_1}\tan\theta_1 = \frac{\mu_3}{\mu_1}\tan\theta_1,$$

which is independent of μ_2.