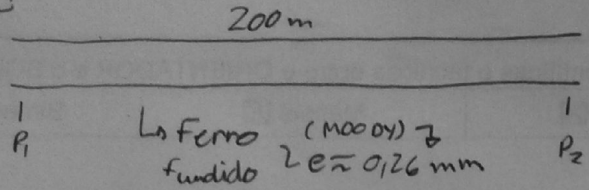
7.103



→ Reg. Perm
→ Incomp.
→ perdas modelo Darcy
→ VELOC. MÉDIA na seção

Bernoulli modificado ① → ②:

ÁGUA $\nu = 1 \times 10^{-6}\ m^2/s$

$$\frac{P_1}{\rho g} + \cancel{z_1} + \cancel{\frac{V_1^2}{2g}} = \frac{P_2}{\rho g} + \cancel{z_2} + \cancel{\frac{V_2^2}{2g}} + H_{PERDAS}^{(1)(2)}$$

$z_1 = z_2$ e C. Massa $Q = V_1 A_1 = V_2 A_2 \rightarrow A_1 = A_2 \Rightarrow V_1 = V_2$

$$\frac{P_1 - P_2}{\rho g} = f \frac{L}{D} \frac{V^2}{2g}$$

$$\frac{500 \times 10^3}{1000 \cdot 9,81} = f \cdot \frac{200}{0,1} \frac{V^2}{2 \cdot 9,81} \Rightarrow \boxed{V^2 = \frac{1}{2f}} \quad (I)$$

$\frac{e}{D} = \frac{0,26}{100} = 0,0026$

eq. Haaland $\frac{1}{\sqrt{f}} = -1,8 \log_{10}\left(\left(\frac{e/D}{3,7}\right)^{1,11} + \frac{6,9}{Re}\right)$

PALPITE $f = 0,025$ para $Re \rightarrow \infty$

↳ eq. Haaland (Veja GRÁFICO ANEXO)

↳ eq. I → $V = 4,47\ m/s$ → $Re = \frac{VD}{\nu} = 4,47 \times 10^5$

NOVO $f(Re, e/D) \Longrightarrow f = 0,0255$ (eq. Haaland)

↳ eq. I $V = 4,43\ m/s$ → $Re = 4,43 \times 10^5$

$f(Re, e/D) \Rightarrow f = 0,0255$ (eq.) → igual ao anterior

(PARAR)

SOLUÇÃO

$V = 4,43\ m/s$ com $f = 0,0255$

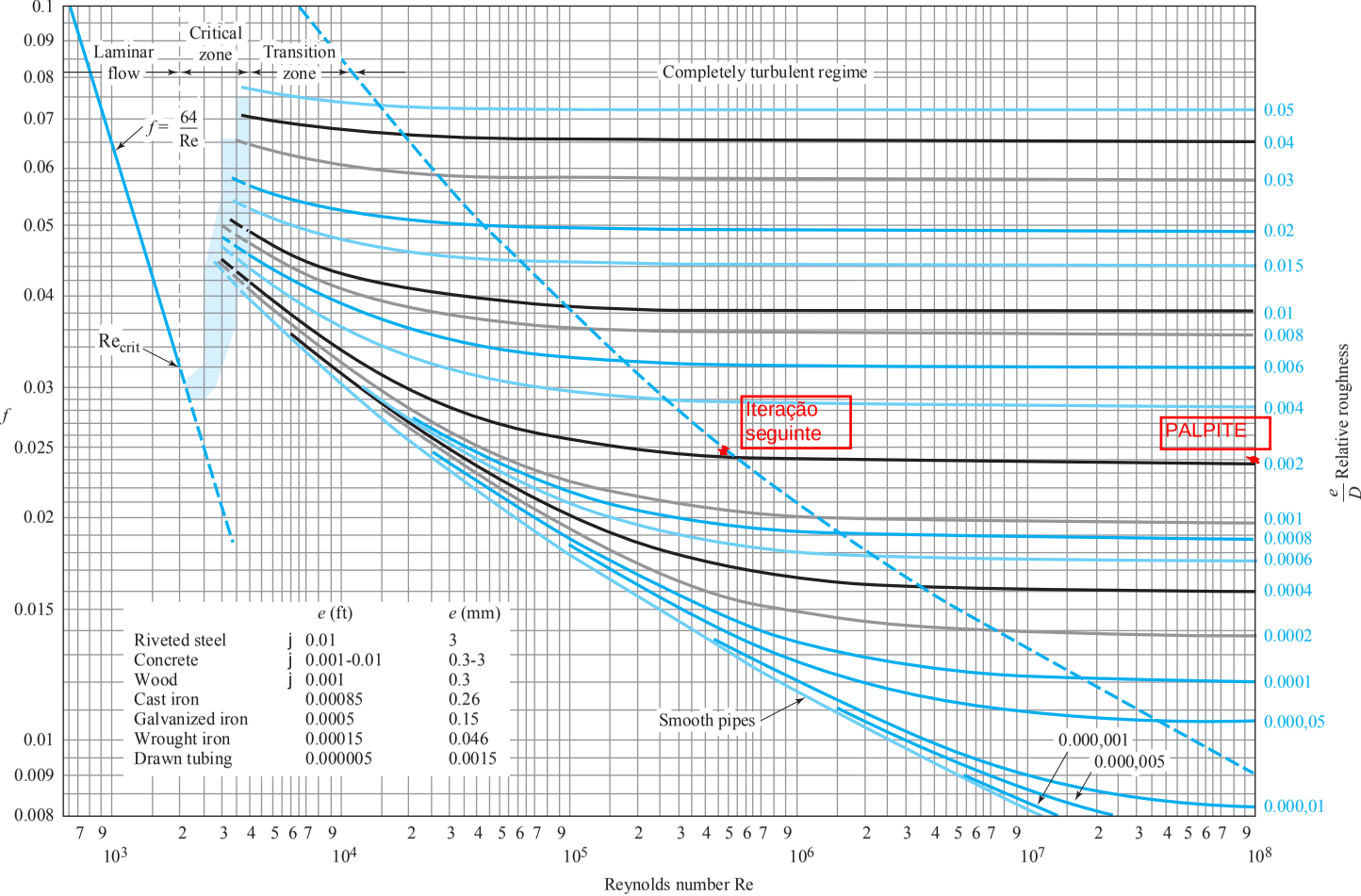


Fig. 7.13 Moody diagram. (From L. F. Moody, Trans. ASME, Vol. 66, 1944. Reproduced with permission of ASME.)
(Note: If