

Μια ρητή, σχετικά απλή και ακριβής σχέση

Papaevangelou et al (2010) noticed that error values tended to “bend” to negative values in an exponential way for Re lower than 10^6 . According to that they chose parameters in their equation

(36):

$$\lambda = \frac{0.2479 - 0.0000947 \cdot (7 - \log_{10} \text{Re})^4}{\left(\log_{10} \left(\frac{\varepsilon}{3.615 \cdot D} + \frac{7.366}{\text{Re}^{0.9142}} \right) \right)^2} \quad (36)$$

Ρητές σχέσεις για τον συντελεστή τριβής f

(10)	$f = \left\{ -2 \log \left[\frac{\varepsilon}{3.7065} - \frac{5.0452}{Re} \log \left(\frac{\varepsilon^{1.1098}}{2.8257} + \frac{5.8506}{Re^{0.8981}} \right) \right] \right\}^{-2}$	$Re = 4000 - 4 \cdot 10^8$	[14]	Chen (1979)
(11)	$f = \left[-1.8 \log \left(0.135\varepsilon + \frac{6.5}{Re} \right) \right]^{-2}$	$Re = 4000 - 4 \cdot 10^8$ $\varepsilon = 0 - 0.05$	[15]	Round (1980)
(12)	$f = \left\{ -2 \log \left[\frac{\varepsilon}{3.7} - \frac{5.02}{Re} \log \left(\varepsilon - \frac{5.02}{Re} \log \left(\frac{\varepsilon}{3.7} + \frac{13}{Re} \right) \right) \right] \right\}^{-2}$	$Re = 4000 - 10^8$ $\varepsilon = 0.00004 - 0.05$	[16]	Zigrang, Sylvester (1982)
(13)	$f = \left\{ -1.8 \log \left[\left(\frac{\varepsilon}{3.7} \right)^{1.11} + \frac{6.9}{Re} \right] \right\}^{-2}$	$Re = 4000 - 10^8$ $\varepsilon = 0.000001 - 0.05$	[17]	Haaland (1983)
(14)	$A = 0.11 \left(\frac{68}{Re} + \varepsilon \right)^{0.25}$ If $A \geq 0.018$ then $f = A$ and if $A < 0.018$ then $f = 0.0028 + 0.85A$	$Re = 4000 - 10^8$ $\varepsilon = 0 - 0.05$	[18]	Tsal (1989)
(15)	$f = \left[-2 \log \left(\frac{\varepsilon}{3.70} + \frac{95}{Re^{0.983}} - \frac{96.82}{Re} \right) \right]^{-2}$	$Re = 4000 - 10^8$ $\varepsilon = 0 - 0.05$	[19]	Manadilli (1997)
(16)	$f = \left\{ -2 \log \left[\frac{\varepsilon}{3.7065} - \frac{5.0272}{Re} \log \left(\frac{\varepsilon}{3.827} - \frac{4.567}{Re} \cdot \log \left(\left(\frac{\varepsilon}{7.79} \right)^{0.9924} + \left(\frac{5.3326}{208.82 + Re} \right)^{0.9345} \right) \right) \right] \right\}^{-2}$	$Re = 3000 - 1.5 \cdot 10^8$ $\varepsilon = 0 - 0.05$	[20]	Romeo, Royo, Monzon (2002)
(17)	$f = 1.613 \left[\ln \left(0.234\varepsilon^{1.1007} - \frac{60.525}{Re^{1.1105}} + \frac{56.291}{Re^{1.0712}} \right) \right]^{-2}$	$Re = 3000 - 10^8$ $\varepsilon = 0 - 0.05$	[21]	Fang (2011)
(18)	$\beta = \ln \frac{Re}{1.816 \ln \left(\frac{1.1Re}{\ln(1+1.1Re)} \right)}, f = \left[-2 \log \left(10^{-0.4343\beta} + \frac{\varepsilon}{3.71} \right) \right]^{-2}$	Not specified	[7]	Brkić (2011)
(19)	$\beta = \ln \frac{Re}{1.816 \ln \left(\frac{1.1Re}{\ln(1+1.1Re)} \right)}, f = \left[-2 \log \left(\frac{2.18\beta}{Re} + \frac{\varepsilon}{3.71} \right) \right]^{-2}$	Not specified	[7]	Brkić (2011)

Χρήσιμες εξισώσεις του f

ΕΞΙΣΩΣΗ

ΟΡΙΑ ΙΣΧΥΟΣ

ΠΑΡΑΤΗΡΗΣΕΙΣ

$$f = \frac{64}{Re}$$

$$Re \lesssim 2000$$

Στρωτή ροή
Για κάθε σωλήνα

$$f = \frac{0,3164}{Re^{1/4}}$$

$$4000 < Re < 10^5$$

Τυρβώδης ροή
Λείοι σωλήνες

Ακολουθεί το διάγραμμα Moody (στην επόμενη σελίδα):

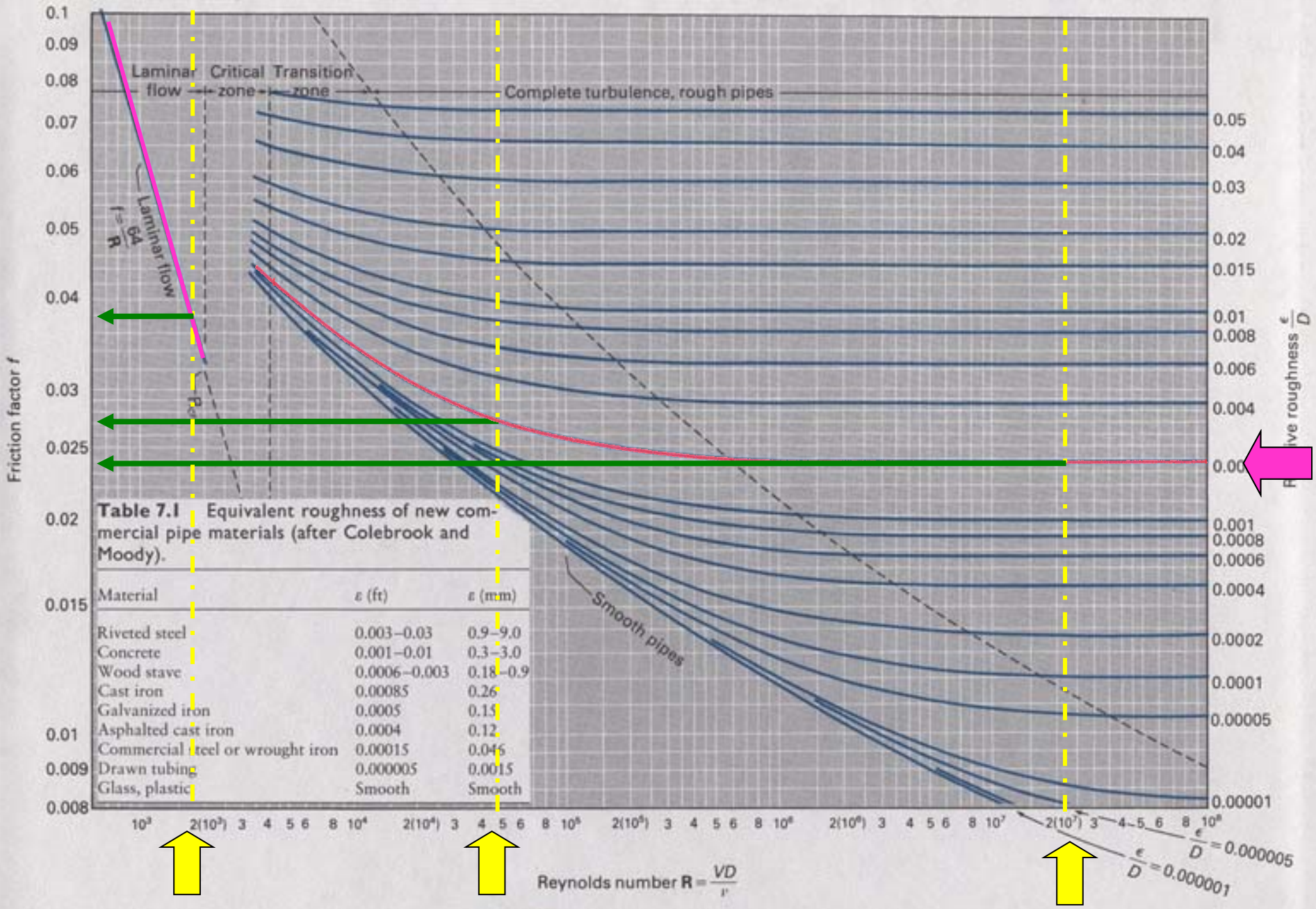


Figure 7.9 The Moody chart for friction factor.