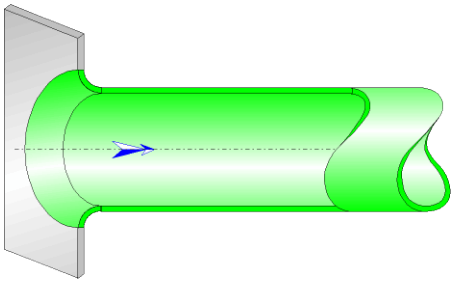
Flush-mounted rounded entrance
Circular Cross-Section
(MILLER)



Model description:

This model of component calculates the minor head loss (pressure drop) generated by the flow in a flush-mounted rounded entrance of piping.

The head loss by friction in the piping is not taken into account in this component.

Model formulation:

Hydraulic diameter (m):

$$D_h = D$$

Pipe cross-sectional area (m^2):

$$A = \pi \cdot \frac{D^2}{4}$$

Mean velocity in pipe (m/s):

$$U = \frac{Q}{A}$$

Mass flow rate (kg/s):

$$G = Q \cdot \rho$$

Reynolds number in pipe:

$$Re = \frac{U \cdot D}{\nu}$$

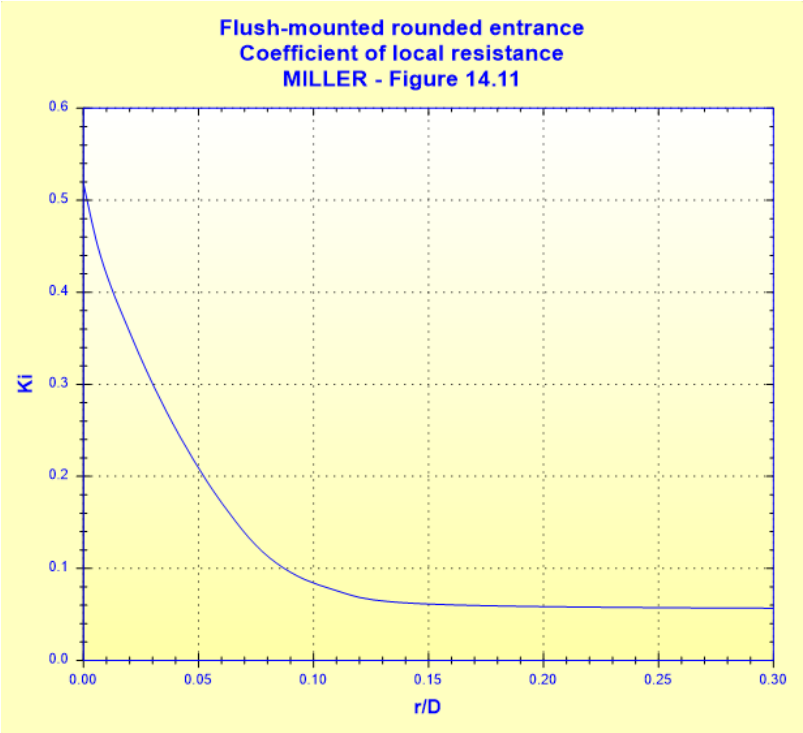
Local resistance coefficient:

- $Re \geq 10^4$

- $r/D \le 0.3$

$$K_i = f\left(\frac{r}{D}\right)$$

([1] figure 14.11)



- $r/D > 0.3$

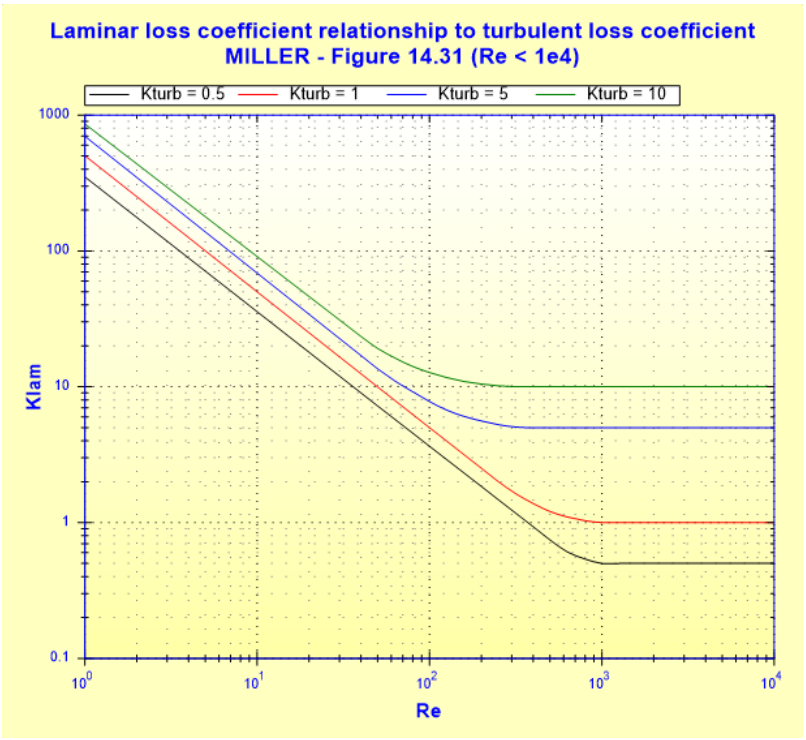
$$K_i = 0.567$$

([1] figure 14.12)

■ $Re < 10^4$

$$K_{lam} = f(\mathrm{Re}, K_{turb})$$

([1] figure 14.31 with $K_{turb} = K_i$)



Reynolds Number Correction ($Re < 10^4$):

$$C_{\mathrm{Re}} = \frac{K_{lam}}{K_i}$$

Total pressure loss coefficient (based on mean velocity in pipe):

- turbulent flow ($\mathrm{Re} \geq 10^4$):

$$K = K_i$$

- laminar flow ($\mathrm{Re} < 10^4$):

$$K = K_{lam}$$

Total pressure loss (Pa):

$$\Delta P = K \cdot \frac{\rho \cdot U^2}{2}$$

Total head loss of fluid (m):

$$\Delta H = K \cdot \frac{U^2}{2 \cdot g}$$

Hydraulic power loss (W):

$$Wh = \Delta P \cdot Q$$

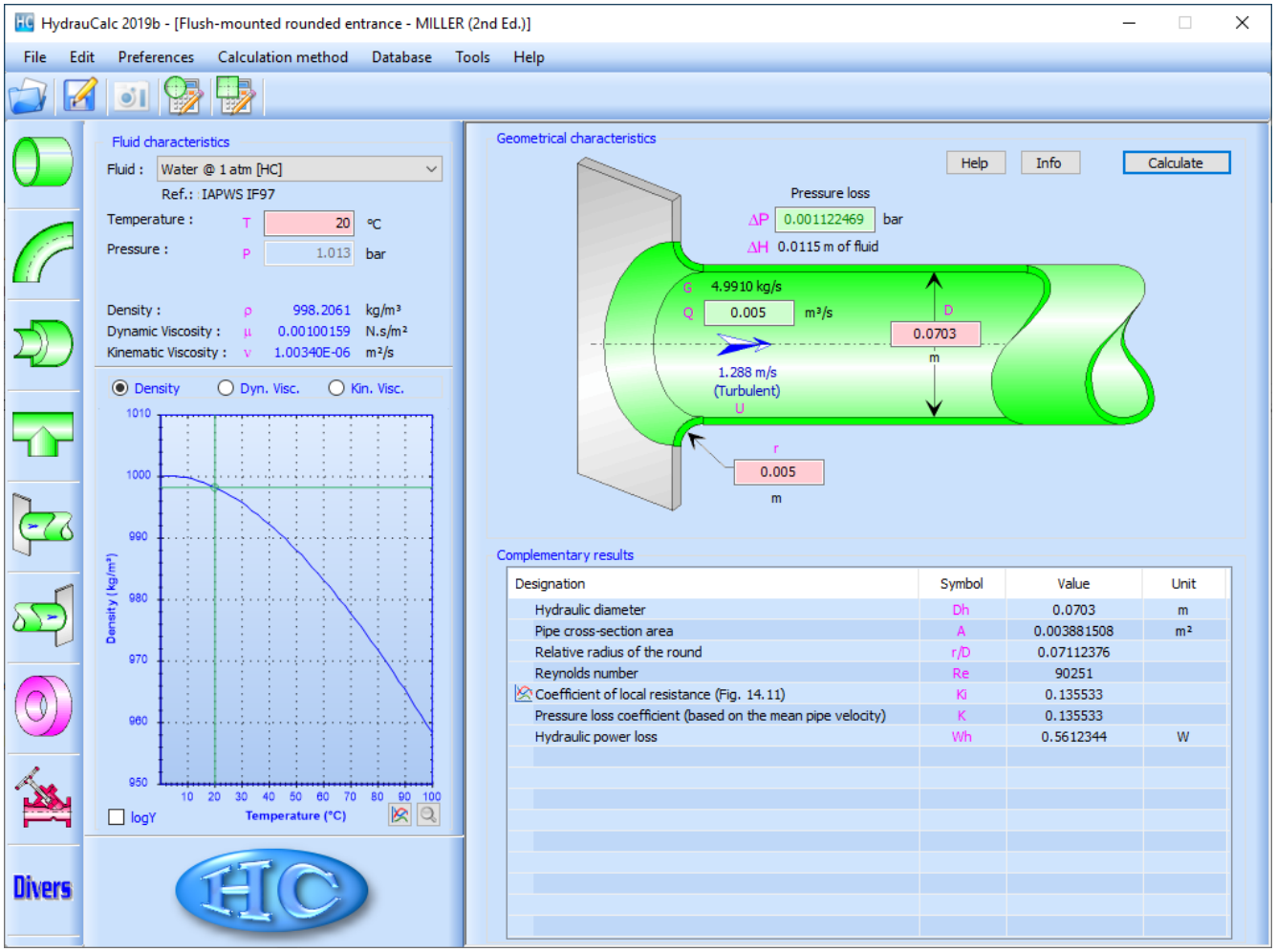
Symbols, Definitions, SI Units:

D_h	Hydraulic diameter (m)
D	Pipe diameter (m)
A	Pipe cross-sectional area (m^2)
Q	Volume flow rate (m^3/s)
U	Mean velocity in pipe (m/s)
G	Mass flow rate (kg/s)
Re	Reynolds number in pipe ()
r	Radius of the round (m)
K_i	Local resistance coefficient for $\mathrm{Re} \geq 10^4$ ()
K_{lam}	Local resistance coefficient for $\mathrm{Re} < 10^4$ ()
C_{Re}	Reynolds number correction for $\mathrm{Re} < 10^4$ ()
K	Total pressure loss coefficient (based on mean velocity in pipe) ()
ΔP	Total pressure loss (Pa)
ΔH	Total head loss of fluid (m)
Wh	Hydraulic power loss (W)
ρ	Fluid density (kg/m^3)
ν	Fluid kinematic viscosity (m^2/s)
g	Gravitational acceleration (m/s^2)

Validity range:

- any flow regime: laminar and turbulent

Example of application:



References:

[1] Internal Flow System, Second Edition, D.S. Miller