Formulaire / equation sheet

Équation de Reynolds 2D / 2D Reynolds equation

$$\frac{\partial}{\partial x}\left(\frac{\rho h^3}{12\eta}\frac{\partial p}{\partial x}\right)+\frac{\partial}{\partial y}\left(\frac{\rho h^3}{12\eta}\frac{\partial p}{\partial y}\right)=\frac{\partial}{\partial x}\left(\rho h\frac{U_1+U_2}{2}\right)+\frac{\partial}{\partial y}\left(\rho h\frac{V_1+V_2}{2}\right)+\frac{\partial}{\partial t}(\rho h)$$

Profil de vitesse dans le cas 2D / Velocity profile for 2D case

$$u=\left(1-\frac{z}{h}\right)U_1+\frac{z}{h}U_2-\frac{1}{2\eta}\frac{\partial p}{\partial x}z(h-z)$$

$$v=\left(1-\frac{z}{h}\right)V_1+\frac{z}{h}V_2-\frac{1}{2\eta}\frac{\partial p}{\partial y}z(h-z)$$

Contraintes de cisaillement dans le cas 2D / Shear stresses for 2D case

$$\tau_{xz}=\eta\frac{\partial u}{\partial z}$$

$$\tau_{yz}=\eta\frac{\partial v}{\partial z}$$

Équation de Reynolds 1D / 1D Reynolds equation

$$\frac{\partial}{\partial x}\left(\frac{\rho h^3}{12\eta}\frac{\partial p}{\partial x}\right)=\frac{\partial}{\partial x}\left(\rho h\frac{U_1+U_2}{2}\right)+\frac{\partial}{\partial t}(\rho h)$$

Profil de vitesse dans le cas 1D / Velocity profile for 1D case

$$u=\left(1-\frac{y}{h}\right)U_1+\frac{y}{h}U_2-\frac{1}{2\eta}\frac{\partial p}{\partial x}y(h-y)$$

Contrainte de cisaillement dans le cas 1D / Shear stress for 1D case

$$\tau=\eta\frac{\partial u}{\partial y}$$

Formulaire de Mécanique des contacts
LUBRIFICATION

Coordonnées cartésiennes

Équation de Reynolds

$$\frac{\partial}{\partial x}\left(\frac{\rho h^3}{\mu}\frac{\partial p}{\partial x}\right)+\frac{\partial}{\partial y}\left(\frac{\rho h^3}{\mu}\frac{\partial p}{\partial y}\right)=6(U_1+U_2)\frac{\partial \rho h}{\partial x}+6(V_1+V_2)\frac{\partial \rho h}{\partial y}+12\frac{\partial \rho h}{\partial t}$$

Vitesses du fluide et contraintes de cisaillement

$$\begin{cases} u=\dfrac{1}{2\mu}\dfrac{\partial p}{\partial x}z(z-h)+\dfrac{h-z}{h}U_1+\dfrac{z}{h}U_2 \\ v=\dfrac{1}{2\mu}\dfrac{\partial p}{\partial y}z(z-h)+\dfrac{h-z}{h}V_1+\dfrac{z}{h}V_2 \end{cases} \qquad \begin{cases} \tau_{xz}=\mu\dfrac{\partial u}{\partial z}=\dfrac{1}{2}\dfrac{\partial p}{\partial x}(2z-h)+(U_2-U_1)\dfrac{\mu}{h} \\ \tau_{yz}=\mu\dfrac{\partial v}{\partial z}=\dfrac{1}{2}\dfrac{\partial p}{\partial y}(2z-h)+(V_2-V_1)\dfrac{\mu}{h} \end{cases}$$

Coordonnées cylindriques

Équation de Reynolds

$$\frac{1}{r}\frac{\partial}{\partial r}\left(\frac{\rho r h^3}{\mu}\frac{\partial p}{\partial r}\right)+\frac{\partial}{r\partial\theta}\left(\frac{\rho h^3}{\mu}\frac{\partial p}{r\partial\theta}\right)=6\rho(V_1-V_2)\frac{\partial h}{r\partial\theta}+12\frac{\partial \rho h}{\partial t}$$

Vitesses du fluide et contraintes de cisaillement

$$\begin{cases} u=\dfrac{1}{2\mu}\dfrac{\partial p}{\partial r}z(z-h) \\ v=\dfrac{1}{2\mu}\dfrac{\partial p}{r\partial\theta}z(z-h)+\dfrac{h-z}{h}V_1+\dfrac{z}{h}V_2 \end{cases} \qquad \begin{matrix} \tau_{rz}=\mu\dfrac{\partial u}{\partial z}=\dfrac{1}{2}\dfrac{\partial p}{\partial r}(2z-h) \\ \tau_{\theta z}=\mu\dfrac{\partial v}{\partial z}=\dfrac{1}{2}\dfrac{\partial p}{r\partial\theta}(2z-h)+(V_2-V_1)\dfrac{\mu}{h} \end{matrix}$$

Paramètres de Dowson

$$\mathbf{H}=\frac{h}{R} \qquad \mathbf{U}=\frac{\mu_o(\mathrm{u1+u2})}{E'R} \qquad \mathbf{G}=\alpha E' \qquad \mathbf{W_1}=\frac{W/L}{E'R}$$

$$\mathbf{W_2}=\frac{W}{E'R_x^2} \qquad k=1.03\left(\frac{R_y}{R_x}\right)^{0.64}\geq 1$$

Ertel-Grubin (1D) $\quad \mathbf{H_o^G}=1.31(\mathbf{UG})^{0.75}(\mathbf{W_1})^{-0.125}$

Dowson (1D) $\quad \mathbf{H_m^D}=0.985(\mathbf{U})^{0.7}(\mathbf{G})^{0.6}(\mathbf{W_1})^{-0.13}$

Dowson (2D) $\quad \mathbf{H_c^D}=1.69(\mathbf{U})^{0.67}(\mathbf{G})^{0.53}(\mathbf{W_2})^{-0.067}\left(1-0.61e^{-0.73k}\right)$

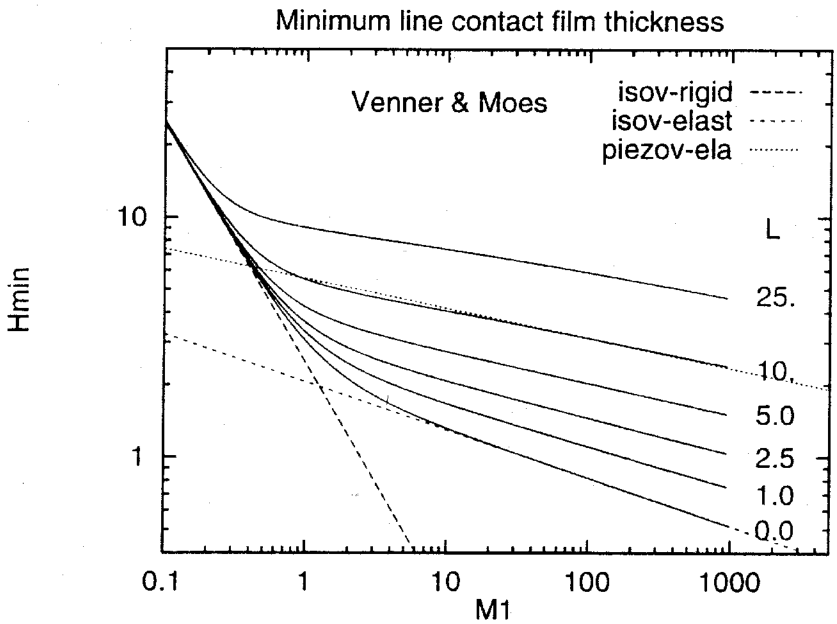
$$\mathbf{H_m^D}=2.27(\mathbf{U})^{0.68}(\mathbf{G})^{0.49}(\mathbf{W_2})^{-0.073}\left(1-e^{-0.68k}\right)$$

Paramètres de Moes et Venner (1D)

$$\mathbf{H}^{MV} = \frac{h}{R\sqrt{\mathbf{U}}}$$

$$\mathbf{L} = \mathbf{G}\mathbf{U}^{1/4}$$

$$\mathbf{M}_1 = \frac{\mathbf{W}_1}{\sqrt{\mathbf{U}}}$$



P.E.

$$\mathbf{H}_m^{MV} = 1.56(\mathbf{L})^{0.55}(\mathbf{M}_1)^{-0.125}$$

I.R. $$\mathbf{H}_m^{MV} = \frac{2.45}{\mathbf{M}_1}$$

I.E. $$\mathbf{H}_m^{MV} = \frac{2.05}{(\mathbf{M}_1)^{0.2}}$$

Paramètres de Moes et Venner (2D)

$$\mathbf{H}^{MV} = \frac{h}{R\sqrt{\mathbf{U}}} \qquad \mathbf{L} = \mathbf{G}\mathbf{U}^{1/4} \qquad \mathbf{M}_2 = \frac{\mathbf{W}_2}{\mathbf{U}^{3/4}}$$

$$\mathbf{H}_c^{MV} = \left[\left\{\left(1.7\frac{t(\mathbf{L})^{3/4}}{(\mathbf{M}_2)^{1/9}}\right)^r + \left(\frac{1.96}{(\mathbf{M}_2)^{1/9}}\right)^r\right\}^{s/r} + \left(\frac{47.3}{\mathbf{M}_2^{\,2}}\right)^s\right]^{1/s}$$

Sphère/plan Rx = Ry = R

avec $$r = \exp\left[1 - \frac{6}{(\mathbf{L}+8)}\right] \qquad s = 12 - 10\exp\left[\frac{-1}{\mathbf{M}_2^{\,2}}\right] \qquad t = 1 - e\,\mathrm{xp}\left[-0.9\frac{\mathbf{M}_2^{\,1/6}}{\mathbf{L}^{1/6}}\right]$$

I.R. $$\mathbf{H}_c^{MV} = \frac{47.3}{\mathbf{M}_2^{\,2}}$$

I.E. $$\mathbf{H}_c^{MV} = \frac{1.96}{(\mathbf{M}_2)^{1/9}}$$