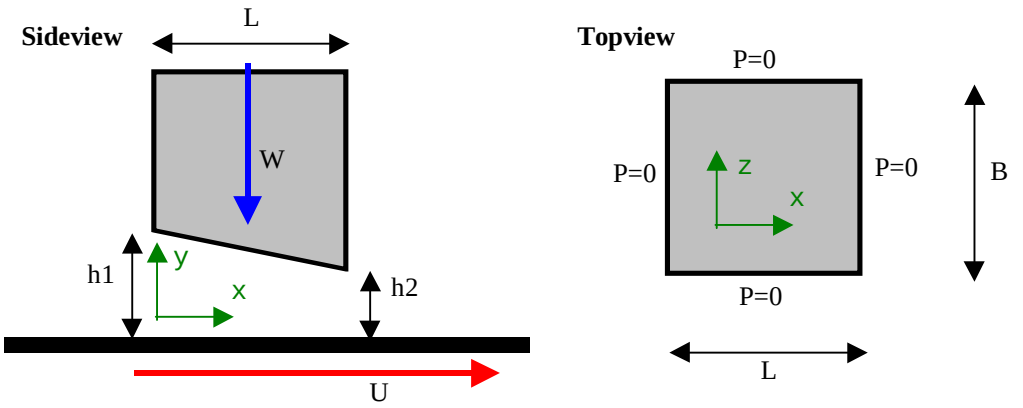
Performance of 1D-Slider Bearing

Modern Lubrication
Luis San Andres (c) 2009

ORIGIN := 0



$h(x) := h_2 \cdot \left[\alpha + (1-\alpha)\cdot\frac{x}{L}\right]$ $\alpha := \frac{h_1}{h_2}$ film thickness profile

(SI units)

U: surface speed - varies

Bearing geometry:

$L := 0.06$ m length and width of bearing

$B := 0.180$

$taper\_angle := 0.001$ rads (machined)

Fluid properties $\mu_{in} := 0.0597$ Pa-sec $\rho := 878$ kg/m3 $c_p := 1880$ J/kg-degC

$\alpha_v := 0.0414$ 1/degC viscosity temperature coefficient

Operating conditions:

$T_{inlet} := 40$ degC - inlet temperature

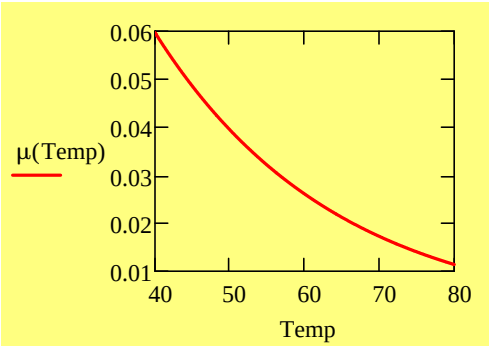
$\kappa_T := 0.80$ thermal convection parameter

$W := 20000$ N external load

visc-Temperature relationship $\mu(T) := \mu_{in} \cdot e^{-\alpha_v \cdot (T - T_{inlet})}$

Calculated performance (Vary runner surface speed)

$U_{min} := 2$ $U_{max} := 20$ [m/s]



Number of cases: $N_{cases} := 10$

Convergence params in load & temperature:

$W_{eps} := 0.001$ $T_{eps} := 0.05$

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GUESS values: $h_2 := 20 \cdot 10^{-6}$ $T_{out} := 55$ based on experience

Specific pressure (bars)

tapered height (h1-h2) $taper := taper\_angle \cdot L$ $taper = 6 \times 10^{-5}$ m

$P_{spec} := \frac{W}{L \cdot B \cdot 10^5}$

$P_{spec} = 18.519$

EXPAND regions below to display code

slider bearing parameters

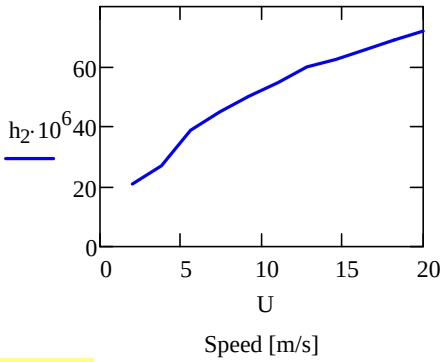
$imax := 24$ Max number of steps for convergence

Iterative loop

GRAPHS of bearing Performance versus runner speed.

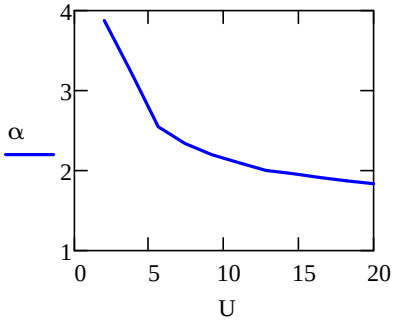
$W = 2 \times 10^4$ [N] - External Load

Min film thickness [microns]



Speed [m/s]

Inlet/outlet film ratio



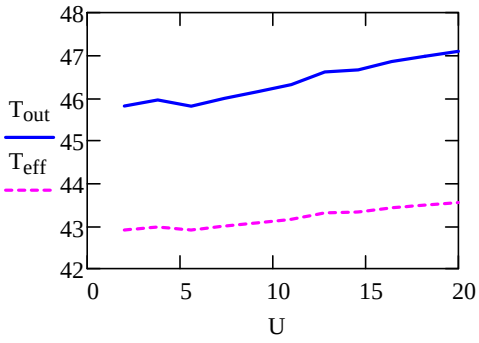
Speed [m/s]

$\max(h_2) = 7.184 \times 10^{-5}$

$\min(h_2) = 2.086 \times 10^{-5}$

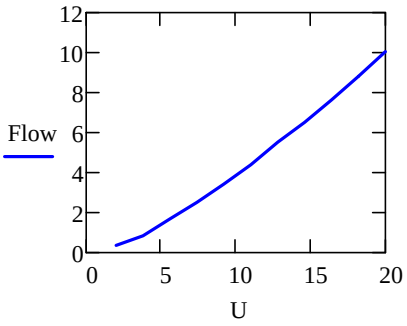
$T_{inlet} = 40$ [C]

Temperatures outlet and effective



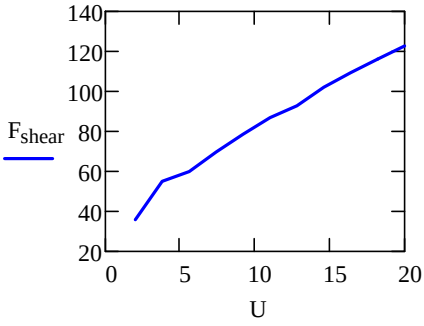
Speed [m/s]

Flow rate [LPM]



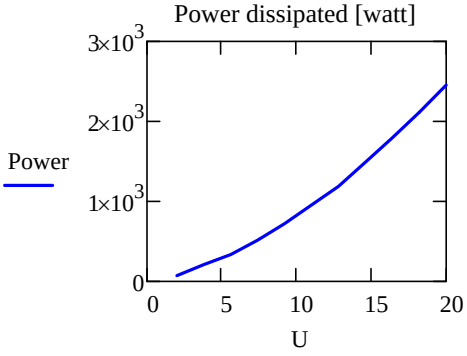
Speed [m/s]

Shear force [N]

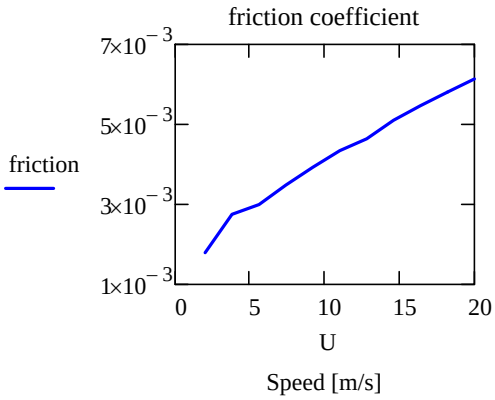


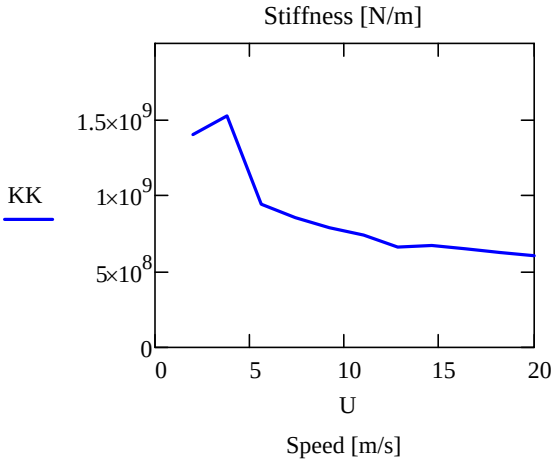
Speed [m/s]

Power dissipated [watt]



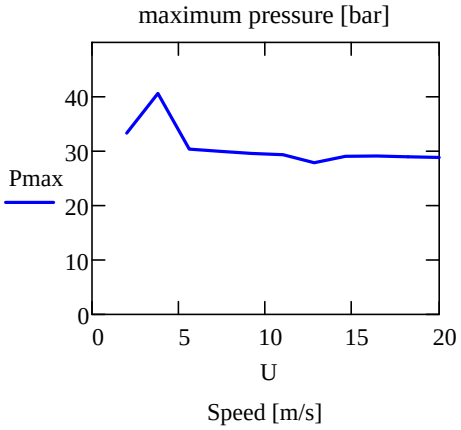
Speed [m/s]





$P_{spec} = 18.519$ [bar]

specific pressure = load/area



imax = 24