CASE 2: Idle Speed (Oil inlet temp = 180F, 800 rpm)

Select Journal Radius (Inch), Length (Inch), Load (lbf), and Oil Inlet Temp (F)

$r := \frac{0.75}{2}$ $L := .75$ $W := 51.0$ $T1 := 180.0$ $rpm := 800$

Define Radial Clearance Range (0.0002 - 0.003 inch)

$c := 0.0004, 0.0006 .. 0.0028$

Define Journal Speed (rev/sec)

$N := \frac{rpm}{60}$

Define Average Oil Temperature (F), i.e., Tavg = T1 + DT/2 (Guess on oil DT, and iterate on calculated value)

$$DTGUESS(c) := 15 \cdot \left(\frac{0.0004}{c}\right)^{1.2}$$

$$T(c) := T1 + \frac{DTGUESS(c)}{2}$$

Define Viscosity (Reyns) vs. Temp for **10W30** oil

$$\mu(c) := 0.7323 \cdot T(c)^{-2.4735}$$

Define Unit Load Capacity (P)

$$P := \frac{W}{2 \cdot L \cdot r}$$

Define Sommerfeld Number (S) as a function of clearance (c), since c is a design variable

$$S(c) := \left(\frac{r}{c}\right)^2 \cdot \mu(c) \cdot \frac{N}{P}$$

Define bearing performance parameters in terms of curve fits provided

(a) Min Film Thickness, ho

$$ho(c) := c \cdot \left(0.0247 + 4.2606 \cdot S(c) - 10.2144 \cdot S(c)^2 + 11.4556 \cdot S(c)^3 - 4.664 \cdot S(c)^4\right)$$

(b) Friction Factor, f

$$f(c) := \frac{c}{r} \cdot \left(0.7316 + 18.9931 \cdot S(c) + 0.1877 \cdot S(c)^2\right)$$

(c) Flow Variable Q

$$Q(c) := (r \cdot c \cdot N \cdot L) \cdot \left(4.8281 - 4.6055 \cdot S(c) + 5.9194 \cdot S(c)^2 - 2.7516 \cdot S(c)^3\right)$$

(d) Side Flow Qs

$$Qs(c) := Q(c) \cdot \left(0.9614 - 2.6056 \cdot S(c) + 3.4272 \cdot S(c)^2 - 1.6012 \cdot S(c)^3\right)$$

CASE 2

Calculate Oil Temp Rise

$$DT(c) := \frac{0.103 \cdot P}{\left(1 - 0.5 \cdot \frac{Qs(c)}{Q(c)}\right)} \cdot \left(\frac{r}{c}\right) \cdot \frac{f(c)}{\frac{Q(c)}{(r \cdot c \cdot N \cdot L)}}$$

Print the variable values

c =	S(c) =	ho(c) =	c) =	Q(c) =	Qs(c) =
$4 \cdot 10^{-4}$	0.22587	$2.34318 \cdot 10^{-4}$	0.00537	0.00609	0.00322
$6 \cdot 10^{-4}$	0.10432	$2.22271 \cdot 10^{-4}$	0.00434	0.00992	0.00719
$8 \cdot 10^{-4}$	0.05975	$1.96151 \cdot 10^{-4}$	0.00398	0.01372	0.01122
0.001	0.03864	$1.74725 \cdot 10^{-4}$	0.00391	0.01747	0.01513
0.0012	0.02701	$1.59068 \cdot 10^{-4}$	0.00398	0.02119	0.01893
0.0014	0.01994	$1.47943 \cdot 10^{-4}$	0.00415	0.02488	0.02266
0.0016	0.01532	$1.40159 \cdot 10^{-4}$	0.00436	0.02855	0.02633
0.0018	0.01213	$1.34834 \cdot 10^{-4}$	0.00462	0.03222	0.02997
0.002	0.00985	$1.31348 \cdot 10^{-4}$	0.0049	0.03587	0.03358
0.0022	0.00815	$1.29262 \cdot 10^{-4}$	0.0052	0.03953	0.03717
0.0024	0.00686	$1.28263 \cdot 10^{-4}$	0.00552	0.04317	0.04074
0.0026	0.00585	$1.28121 \cdot 10^{-4}$	0.00584	0.04681	0.0443
0.0028	0.00505	$1.28665 \cdot 10^{-4}$	0.00618	0.05045	0.04785

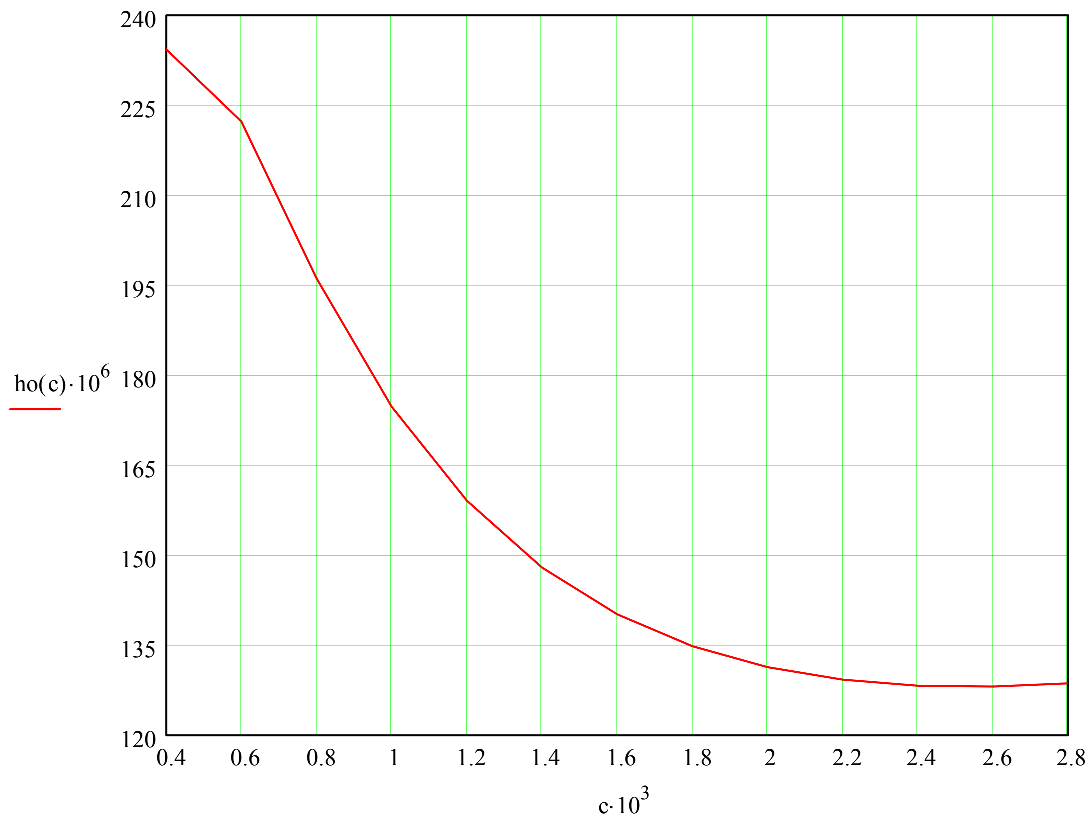
Print Oil Temperature Rise (guess and calculated), Average Oil Temp, and oil Viscosity

DTGUESS(c) =	(Calculated DT) DT(c) =	Avg oil temp T(c) =	$\mu(c) \cdot 10^{6}$ =
15	15.7441	187.5	1.74751
9.22108	9.02096	184.61054	1.81595
6.52913	6.44878	183.26456	1.84912
4.99532	5.1807	182.49766	1.8684
4.01371	4.46289	182.00685	1.88088
3.33587	4.01803	181.66794	1.88958
2.84197	3.72377	181.42098	1.89594
2.46738	3.51925	181.23369	1.90079
2.17434	3.37147	181.08717	1.9046
1.93935	3.26128	180.96967	1.90766
1.74707	3.17696	180.87353	1.91017
1.58707	3.11103	180.79353	1.91226
1.45202	3.05851	180.72601	1.91403

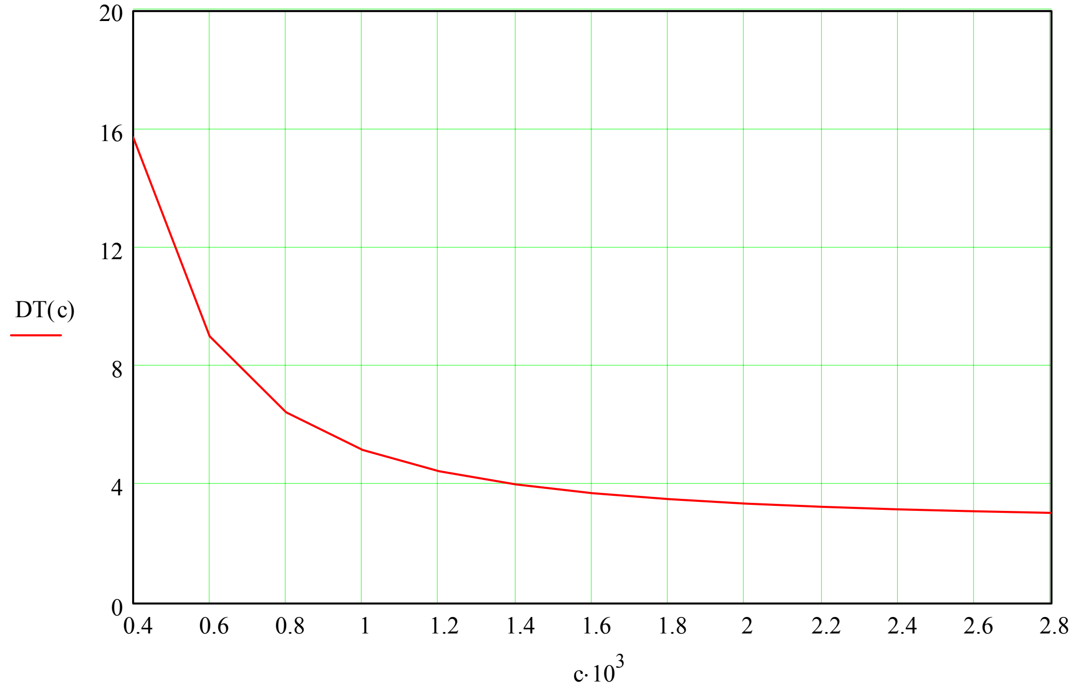
CASE 1

Plot Variables

Min Film Thickness Vs. Clearance



Oil Temp Rise (F) Vs. Clearance



20
16
12
8
4
0
DT(c)
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
c·10^3