Case 12_4f

Design of an aerostatic shallow pocket thrust bearing.

Problem: Aerostatic bearing shown in Fig.12.10

$MPa := 10^{6} \cdot Pa$

Diameter bearing: $D_0 := 40 \cdot mm$ $R_0 := 0.5 \cdot D_0$ $R_0 = 20\,mm$

Diameter pocket: $D_1 := 32 \cdot mm$ $R_1 := 0.5 \cdot D_1$ $R_1 = 16\,mm$

Gas inlet diameter: $D_2 := 1 \cdot mm$ $R_2 := 0.5 \cdot D_2$ $R_2 = 0.5\,mm$

Film thickness: $h_0 := 5 \cdot 10^{-6} \cdot m$

Pocket depth: $h_2 := 5 \cdot 10^{-6} \cdot m$

Ambient pressure: $p_a := 0.1 \cdot MPa$

Supply pressure: $p_s := 0.5 \cdot MPa$

Gas properties: $\eta := 18 \cdot 10^{-6} \cdot Pa \cdot s$ $R := 287 \cdot \frac{m^2}{s^2 \cdot K}$ $T := 293 \cdot K$

1) Flow rate and intermediate pressure:

2) Pressure drop over inlet:

3) Load capacity:

4) Inherent stiffness:

Load capacity: $F = 240.61\,N$

Dimensionless load capacity: $F_1 = 190.05563\,N$ $Ae\_A = 0.945$

Pressure after the restrictor: $\frac{p_r}{p_s} = 0.605$ $\beta = 0.507$

Axial bearing stiffness: $S = 24\,10^{6} \cdot \frac{N}{m}$

Flow rate : $M = 7.905 \times 10^{-6} \frac{kg}{s}$ $Q = 0.399 \frac{liter}{min}$