Case 12_4e

Design of an aerostatic thrust bearing with slot feeding.

Problem: Aerostatic thrust bearing shown in Fig.12.1c and Fig.12.13b.

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

Diameter 2R0: $D_0 := 40 \cdot mm$ $R_0 := 0.5 \cdot D_0$

Diameter 2R1: $D_1 := 24.2 \cdot mm$ $R_1 := 0.5 \cdot D_1$

Diameter 2R2: $D_2 := 23.8 \cdot mm$ $R_2 := 0.5 \cdot D_2$

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

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

Pressure factor: $\beta_0 := 0.6$

Number of orifices: $n := 3$

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

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

$\rho_0 := 1.208 \cdot \frac{kg}{m^3}$ $\kappa := 1.4$ $C_D := 0.7$

1) Load capacity:

2) Flow rate:

3) Dimensions orifice restrictor:

4) Axial bearing stiffness:

Load capacity: $F = 208.31\,N$

Dimensionless load capacity: $F_1 = 0.41441$ $Ae\_A = 0.691$

Axial bearing stiffness: $S = 68.273\,10^{6} \cdot \frac{N}{m}$

Pressure after the restrictor: $\frac{p_r}{p_s} = 0.68$

Flow rate : $M = 4.543 \times 10^{-6}\,kg\,s^{-1}$ $Q = 0.229\,\frac{liter}{min}$

Diameter simple orifice: $d_s = 0.11\,mm$