C12_4a

Design of a circular aerostatic thrust bearing with inherent orifice restrictor.

Problem: Aerostatic thrust bearing shown in Fig.12.13a.

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

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

Dimameter orifice: $D_1 := 0.167 \cdot mm$ $\quad R_1 := 0.5 \cdot D_1$ $\quad R_1 = 0.084\,mm$

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

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

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

Pressure factor: $\beta_0 := 0.6$

Coefficient of discharge: $C_D := 0.7$

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

$\rho_0 := 1.208 \cdot \dfrac{kg}{m^3}$ $\quad \kappa := 1.4$

1) Load capacity:

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2) Flow rate:

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3) Dimensions orifice restrictor:

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4) Axial bearing stiffness

Load capacity: $F = 46.196\,N$

Dimensionless load capacity: $F_1 = 0.0919$ $\quad Ae\_A = 0.153$

Axial bearing stiffness: $S = 12.32\,10^{6} \cdot \dfrac{N}{m}$

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

Flow : $M = 4.167 \times 10^{-7} \dfrac{kg}{s}$ $\quad Q = 0.021 \dfrac{liter}{min}$

Diameter inherent orifice: $d_a = 0.167\,mm$