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THE THERMAL REGIME ON THE BORDER OF COMBINED HYDRODYNAMIC BEARINGS

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Abstract. The calculation of the parameters of combined bearings with unique flow rate requires knowledge of the supply temperatures of the two. While the temperature of the oil used by the radial component is known we need to determine the entrance temperature in the axial component. Based on the observation of the bearing, this study proposes a calculation relationship for the medium supply temperature of the axial component.

1. INTRODUCTION

To the difference of conical and spherical bearings, the radial-axial hydrodynamic bearing with unique flow rate present the following advantages: smaller gauge, simultaneous taking on of both radial and axial loads, firmness upon greater rotation speed, lower cost, increased fiability a.s.o.

2. LOGICAL SCHEMATA FOR THE CALCULATION OF THE COMPONENT'S PARAMETERS

As the literature amply shows, a realistic tackling of hydrodynamic bearings' lubrication has to consider the thermal aspects as well. Based on the detailed mathematical model in [2], for the observed bearing presented in [1], the necessary logical schemata for the thermohydrodynamic parameter calculation have been released. The two logical schemata presented in Figures 1 and 2 delineate the main stages for the calculation of temperature, loads, and moments of shearing, a.s.o. The link between the two is ensured by the lubricant's flow. In a first simplifying hypothesis, the flow running along the radial-axial bearing could be seen as equal to the total flow that leaves the axial bearing. This flow originates in the corrected leaking flow rate out of sides, of the radial component, to which the fresh oil of the supply channels is added. Taking into consideration the medium temperature of the oil leaving the radial component, Tmrc11, of the supply oil Tir, and on the above-mentioned premise, we obtain successively:

$$\mathrm{N}_{\mathrm{k,i}} = \frac{\mathrm{Qsr}_{\mathrm{k,i}}}{\mathrm{I}_{\mathrm{i}}}, \tag{1}$$

$$M_{k,i} = \sum_{i=0}^{2} N_{k,i}, \tag{2}$$

$$Tia_{k,i} = \frac{M_{k,i} \cdot Tmrc11 + (Qsa_i - M_{k.i}) \cdot T_1}{Qsa_i}. \tag{3}$$

Where:

$\mathrm{Qsr}_{k,i}$, Qsa_{i}, is leaking flow rates out of sides of the radial component, and of the axial one, respectively;

Ii, represents the correction functions corresponding to the lobes, according to [3];

$M_{k,i}$, represents the sum total of the corrected leaking flow rates of sides of the radial component;

$Tia_{k,i}$, is the temperature of the mixture of oil belonging to the axial component.

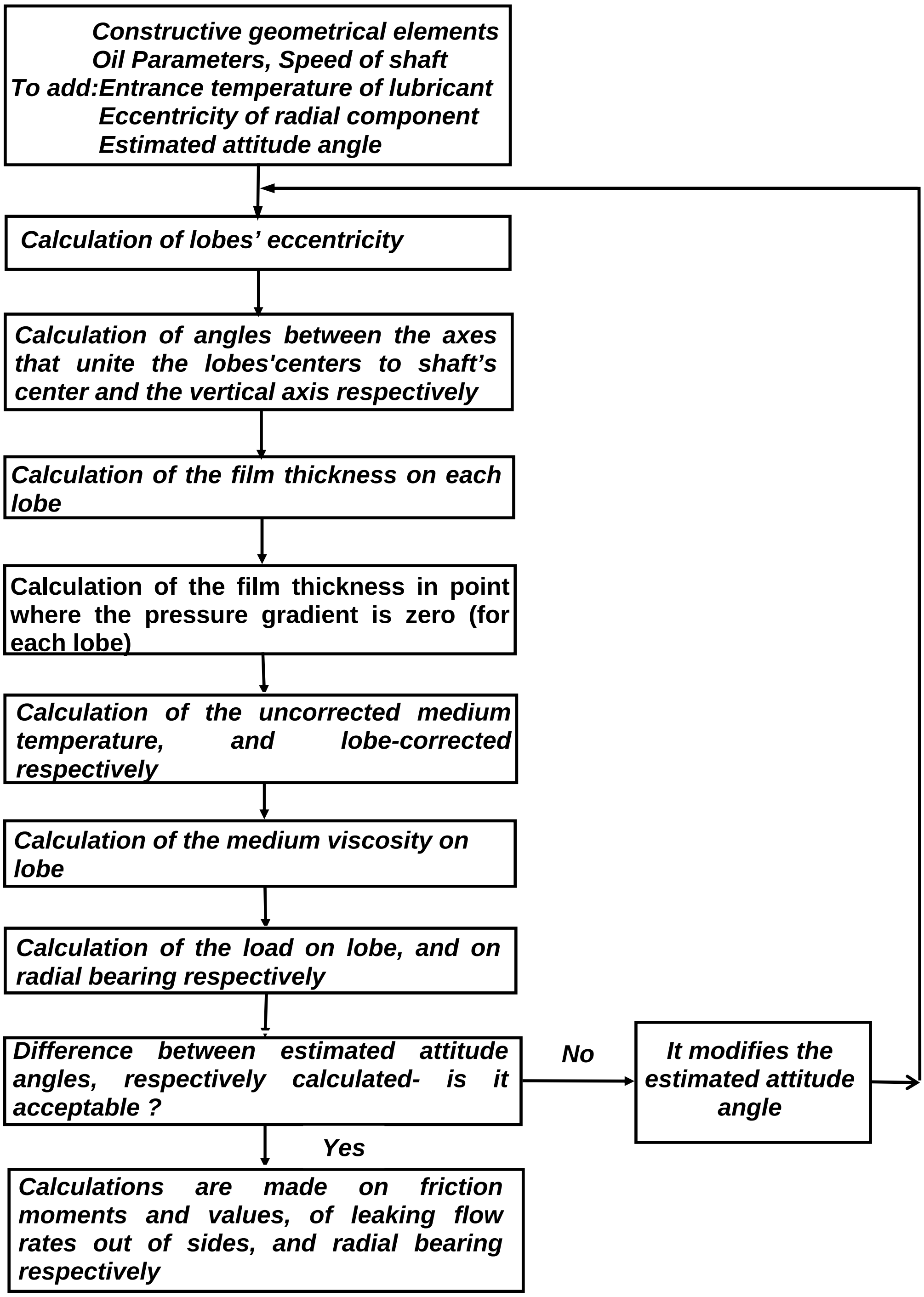

Fig. 1. Logical calculation schema of radial component's parameters

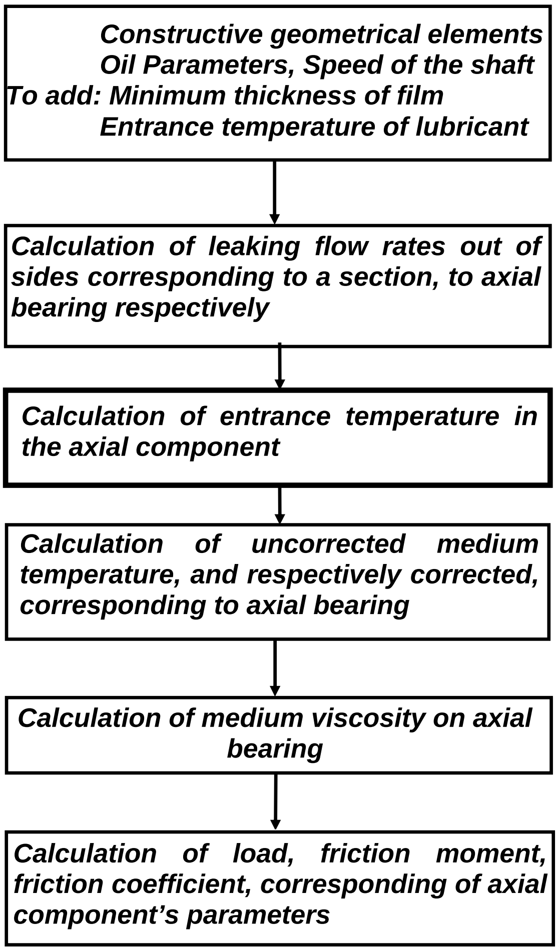

Fig. 2. Logical calculation schema of axial component's parameters

3. EXPERIMENTAL RESULTS

In Table 1, the temperatures that have been obtained experimentally (Te) and through calculation respectively (Tc) are presented; they represent the oil mixture in the transit from the radial to the axial component.

Table 1. Rotate speed: 11200 rpm

Nr. Crt.	*Load [N]*		*T_1 [^{0}C]*	*T_e [^{0}C]*	*T_c [^{0}C]*
	Radial	*Axial*			
1	*300*	*450*	*22*	*28,40*	*29,25*
2		*550*	*22*	*28,60*	*29.50*
3		*600*	*22*	*28,90*	*30,40*
4		*700*	*22*	*29,05*	*31,20*
5		*750*	*22*	*29,30*	*31,00*
6		*1000*	*22*	*30,00*	*31,50*

The temperature calculated with the help of relation 3, indicate an acceptable accuracy, the errors being less then 10%, relative to the experimental results. The concurrence theory-experiment bears out the correctness of the deductive rationale of relation 3. T_1 represents the initial temperature of the lubricant at the entrance in the radial component.

4. CONCLUSIONS

The proposed relationship ensures unity between the logical calculation schemata for the parameters of the two components. The mechanical link between the two is seen thermally owing to the flow rate along the combined bearing. The suggested calculation program makes it possible that a rigorous assessment of the radial-axial hydrodynamic bearing be made.

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