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INFLUENCE OF THE LUBRICANT'S TEMPERATURE AT DISPLACEMENT JOURNAL BEARINGS IN TRANSIENT RESPONSE OF ROTOR BEARING SYSTEMS

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ABSTRACT
In this paper the influence of the lubricant's temperature through viscosity coefficient μ *at the displacement journal bearings in transient response of rotor bearing systems.*
The equations of rotor/bearing system are at a position where coordinates of the rotor and the disk during the motion are at the origin of static equilibrium
The system rotor/bearing was analysed for rotor supported at hydrodynamic bearing with infinite short length for laminar flow of lubricant in bearing – without turbulence and without cavitations and as well as without error at mounting of the bearing
Results are presented graphically through which the conclusions have been made.
The Simulations has been performed in Mathcad software.
Keywords: *Rotor/Bearing System, Lubricant's Temperature, Turbulence, Viscosity Coefficient*

1. INTRODUCTION

In this paper the influence of lubricant temperature in the bearings at the adopted rotor/bearing system is analyzed. The influence was described through viscosity coefficient μ at the displacement journal bearings in transient response of rotor bearing systems.
Eccentricity (*e*) of the journal, stiffness coefficients, journal speed, viscosity, mass, imbalance, excitation and geometry of bearing (L/D report) has been taken into consideration.
The rotor is supported at hydrodynamic bearings with laminar flow of lubricant without turbulence and without cavitations. The mounting/assembling error of bearings has not been taken into account. All these effects were considered for the bearing with infinite short length.

2. MECHANICAL MODEL

To analyse the rotor-bearing system the mechanical model was adopted considering the rotor as flexible supported at bearings with infinite short length $(L/D<0,5)$ and the flow of lubricant in bearing is laminar – without turbulence and without cavitations and neglecting the error of bearing mounting.

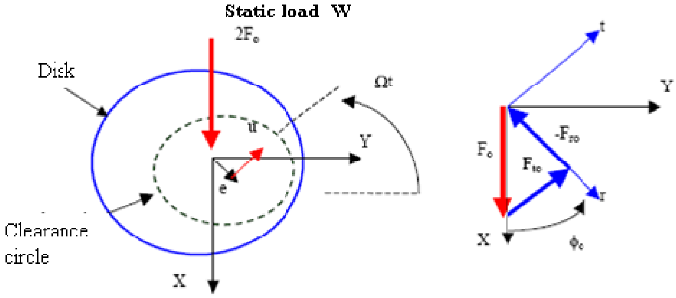

Figure 1.

Where,

C - radial clearance of oil film;
Cij - dumping coefficients;
K*ij* - stiffness coefficients;
ε - journal eccentricity;
ϕ - positional angle of bearing;
L - axial length of bearing;
Ω –angular velocity of journal

Initial Conditions:
$t_0=0;$
$X_0=10^{-6}\ [m]\ ;$
$Y_0=0;$
$(dX/dt)_0=(dY/dt)_0=0$ *- Velocity*

Transient Solution:
$N_{rev}=2^5$ - *Number of shaft revolutions*
$N_{step\ rev}=2^7$ – *Time steps per revolutions*
$\mathbf{t_f}=[N_{rev}/(\omega/2\pi)]+t_0=0{,}64\quad [s]$ - *Total time response*
c- Bearing radial clearance

3. RESULTS OF THE ANALYSIS

The results of the analysis based in adopted model expressed are graphically presented in Figures 2, 3 and 4 respectively for three working temperatures 60 ºC, 75 ºC and 90ºC for the constructive dimensions and data for a rotor of Siemens AG turbogenerator [6, 7]. The analysis has been carried for an optimal value of relation *L/D=0,45* [6].
Results and graphs are processed through MathCad software.

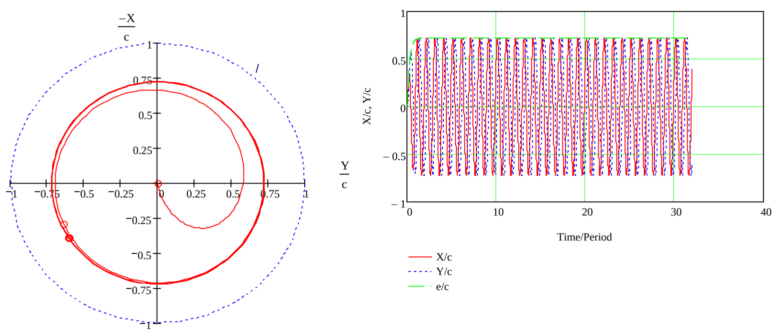

Figure 2. Non dimensional orbit plot and Displacement of journal bearings-60 ºC

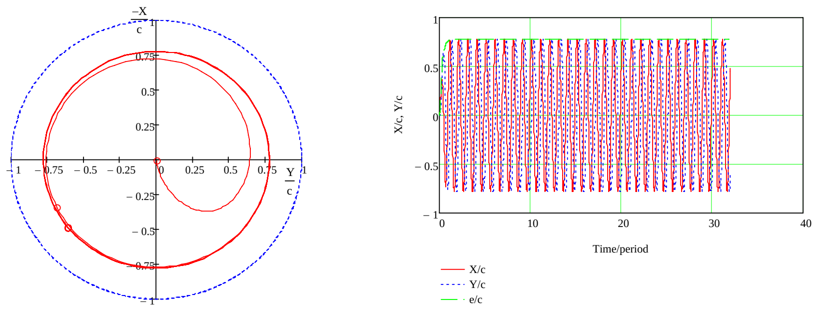

Figure 3. Non dimensional orbit plot and Displacement of journal bearings-75 ºC

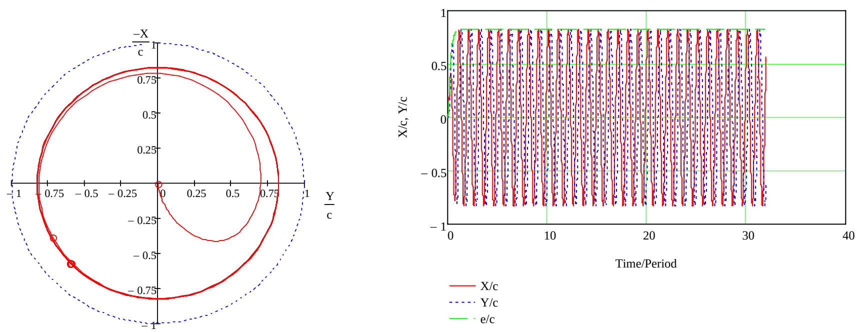

Figure 4. Non dimensional orbit plot and Displacement of journal bearings-90 ºC

4. CONCLUSIONS

Based in analysis and the graphical presentation of the results can be concluded that:

- With increase of the working temperature of lubricant the non-dimensional orbit of journal bearing is wider, (*Figure 2,3 and 4- Non dimensional orbit plot)*;
- With increase of the working temperature of lubricant the maximal amplitudes of the centre of journal bearing at transient regime are higher (*Figure 2,3 and 4-Displacement of journal bearing)*

5. REFERENCES

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