Noise reduction of rolling bearing applications using viscoelastic layers

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Introduction

The demand for silent bearing applications, like gearboxes and electric motors, has resulted in a research project in cooperation with SKF on the development of a viscoelastic damping layer.

Objectives

The investigations aim to develop an effective damping layer mounted between the bearing and the surrounding structure.

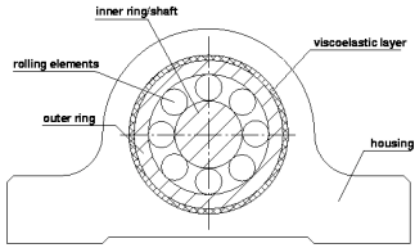

Figure 1 : Viscoelastic layer mounted between the bearing and the housing

The influence of material, design and mounting properties will be studied to optimize the layer.

Methods

The housings and the shaft of the application are modelled with FEM, whereas rolling contacts are represented by spring-damper models [1]. Viscoelasticity is described with Maxwell elements or with fractional derivative models. Both modal analyses and transient response calculations are performed.

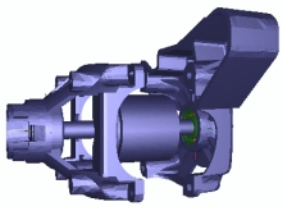

Figure 2 : Model of electric motor using FEM for the housing and the shaft

Results

A transient analysis was performed on the application shown in figure 3 with two viscoelastic layers mounted between the bearing and the housing.

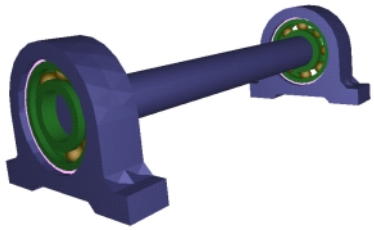

Figure 3 : Model of bearing application

The dynamic behaviour of the application is affected by the viscoelastic layers over a wide frequency range.

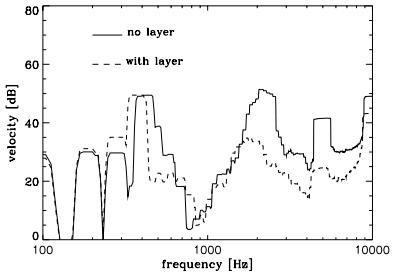

Figure 4 : Convoluted spectra (radial response) of housing with and without layer

Conclusions and further research

By using thin viscoelastic layers in a rolling bearing application, radiating sound from the housings may be reduced as vibrations of the shaft are isolated.
In order to optimize the layer design more advanced numerical tools are being developed. Additionally, experiments will be carried out to investigate practical issues, material behaviour and to validate the model.

References

1. Wensing, J.A. (1998) On the dynamics of ball bearings, PhD-thesis, University of Twente, Enschede.