Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 24 (2016) 406 – 411

Procedia Technology

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

Magnetorheological fluids examination for antivibration mounts at impact loads

Gordeev B.A.[a,]*, Dar'enkov A.B.[a], Okhulkov S.N.[a], Plekhov A.S.[a]

[a] *Institute of Electric Power Engineering, NNSTU n.a. R.E. Alekseev, Nizhny Novgorod 603950, Russia*

Abstract

In this work the question of magnetorheological fluids usage in damping systems of electromechanical power installations and machinery are studied. The physical backgrounds of magnetic fluids characteristics operation with respect to inner magnetic fields are considered. The processes appearing in magnetorheological fluids at impact loads are looked into. These tasks are solved within the frame of magnetorheological fluid only due to the fact that electromagnetic impulses appear on solenoid windings which are meant to create an inner control magnetic field. The amplitude and the impulses duration is an impact load function. Their influence is to be taken into account when developing magnetorheological dampers.

Peer-review under responsibility of the organizing committee of ICETEST – 2015

Keywords: magnetorheological fluids; magnetorheological transformers

1. Introduction

Increasing the power of the electromechanical and mechanical equipment causes an increase the amplitude of the vibration, the expansion of the spectrum of vibrations and shocks. This affects the reliability and safety of operation of the equipment. Thus it is necessary to improve the vibration protection systems and to implement new engineering solutions. Developing magnetorheological dampers of impact loads oscillations is a prospective trend nowadays. In these oscillations energy dissipative processes in magnetorheological media [1, 2, 3] take place.

* Corresponding author. Tel.: +0-000-000-0000 .
E-mail address: gord349@mail.ru

Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.056

This article shows an approach to solve the vital task of magnetic fluids characteristics research under the impact loads with inner and outer electromagnetic fields [4, 6, 7].

2. Main results

The process of integrated dampers (hydromounts) associated with the use of magnetorheological fluids [1, 2, 3]. Thus one of the most vital tasks is to investigate the magnetorheological fluids characteristics at impact loads. The possibility to control the magnetorheological viscosity in magnetorheological transformers (MRT) chocking channels at inner and outer electromagnetic fields influence is test-proven [4, 6, 7].

When demonstrating magnetorheological and electrorheological media movement at the magnetic field influence, the following conditions are taken into account [5]

$$\omega_0 \tau << 1,$$

where ω_0 – Larmor procession frequency for ionized molecules of the working fluid, τ - ionized molecule mean free path time, electrical conductivity - γ too much, thus

$$\frac{\varepsilon}{4\pi} \cdot \frac{\omega}{\gamma} << 1$$

where ω – external signal frequency, ε – relative dielectric permeability.

During electromagnetic fluid choking, the induction current with current density appears in the magnetic field

$$\boldsymbol{J} = \frac{\gamma}{c}[\boldsymbol{VH}]$$

where c – light speed, $\boldsymbol{H}$ – external magnetic field strength, $\boldsymbol{V}$ – the electrorheological fluid flow speed.

To test the mechanical impulse load on a single-channel inductive MRT there has been created an impact loads experimental test unit. Fig.1 shows the test unit.

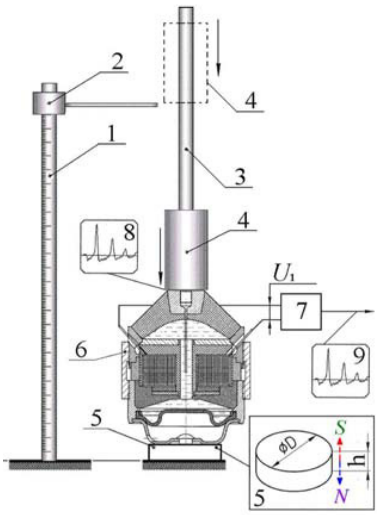

Fig. 1. Impact loads test unit chart for a single-channeled inductive magnetorheological damper at a falling weight mechanical shock.