RESEARCH AND APPLICATION OF INTELLIGENT SUSPENSION

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ABSTRACT

Magnetic fluid constitutes ferrite particle , surfactant and carrier. The ultra-fine particles with strong magnetism can disperse stably in the liquid due to the action of the surfactant. If the carrier is silicon oil, it is called a silicon-based ferrofluid. For this research , we synthesize a series of Fe3O4 silicon-based ferrofluids with various concentrations by coprecipitation method. The conditions of the chemical reaction were carefully tuned to obtain the optimum ones. The ferrofluids produced accordingly are highly stable with high magnetization. Then we apply to linear dampers using different concentration silicon-based ferrofluids.The effects of these dampers to vibration reduction were studied. The main difference between dampers using conventional damper oil and those using silicone-based magnetic fluid is that the viscosity of the later one can be altered as needed. Through the control of the magnetic field to the damper, the vibration reduction system becomes intelligent. Also, the possibility of direct contact between damper components can be eliminated completely due to the repulsive force between the magnetic fluid and the non-magnetic materials, which can prevent excessive wear due to dry friction. All these miracles are due to the face that as a magnetic field is applied, the magnetic particles in magnetic fluids will agglomerate and form chains along the direction of the field. If the direction of the vortices resulted from the relative of moving components is not parallel to the direction of the magnetic field, the viscosity of the fluid will be enhanced and are controllable. Furthermore, the silicone-based magnetic fluid will tend to move to the location of the highest field strength. By properly designing the magnetic field, the amount of fluid used will reduce tremendously. In this resecrch, silicone-based magnetic fluids of different grades and different concentrations were produced. Their mechanical properties were measured at different magnetic strengths. An linear damper using these fluids as damper fluid was tested in order to understand the effects of the damper with different magnetic fluids. A database then was constructed accordingly base on the test results. A control methodology was developed based on the database and was used to control system vibration actively through the computer control. Such a damper, which its viscosity is controlled by a computer based on this database, subdues external forces to the system and reduce the vibration level of the system. This system can be used in highly accurate instruments, vehicles, or machines which are required a law vibration level. Also the results can be uses a guideline by industries in the design of magnetic fluid dampers.

Keywords : Magnetic Fluid ; Suspension

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