Magneto Rheological Fluid High Torque Transfer Device for Improved Clutch Design

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a magneto rheological (MR) fluid device capable of providing high torque transfer for clutch applications.

OVERVIEW

MR fluids are a suspension of micrometer-size magnetizable particles in a carrier fluid, typically a hydrocarbon oil. When the fluid is exposed to a magnetic field, the magnetizable particles form columns or stripes in the direction of the applied field, increasing the viscosity of the fluid. When the magnetic field is applied, the stress required to make the fluid flow, called the “yield stress” of the fluid, increases in a matter of milliseconds. It can be reversed just as quickly by controlling the current to a field coil, which supplies the magnetic field. This property of MR fluids allows them to be utilized for controlling the fluid coupling between two rotating members or changing the flow rate through a pipe, channel or orifice.

In an effort to capitalize on this phenomenon, MR clutches have been developed as an alternative to hydraulic actuated clutches. However, MR clutches offer lower amounts of torque per unit volume, called “torque density,” than hydraulic clutches and require high amounts of power to deliver the desired torque for a given device size. This results in large clutches and/or high power consumption, making MR clutches unable to compete with other technology. A new device is needed that can achieve improved torque transfer capabilities without affecting device size or power efficiency.

THE INVENTION

UW-Madison researchers have developed an improved MR clutch design. This MR clutch achieves high torque transfer without increasing power consumption and maintains the footprint of the device.

The clutch is composed of a drum-shaped rotor, which has a rotational degree of freedom with respect to a cylindrical stator and magnetic field generator. The stator and rotor define an annular, or ring shaped, space between the two that can be filled with the MR fluid. The magnetic field generator produces a radially directed magnetic field across the annular space that causes stationary stripes of magnetizable particles in the MR fluid to...
form and create a fluid couple between the rotor and stator. The stator and rotor are configured with ring-like flow channels that aid in the creation of the magnetized particle strips, thus increasing the transferred torque.

APPLICATIONS

• Controllable torque-transfer for clutch devices (fan clutches, driveline clutches, etc.)
• Fluid coupling for effective torque with respect to a rotary shaft

KEY BENEFITS

• Increases torque and power efficiency
• Enables the use of different construction material to modify power and torque efficiency
• Reduces footprint of previous MR clutches
• Uses low cost materials

ADDITIONAL INFORMATION

Tech Fields
Engines & Power Electronics - Automotive

CONTACT INFORMATION

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842.