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Magneto-rheological clutch to control variable speed for pumping units

Author: Sebastian Muntean[1]

Co-authors: Alin-Ilie Bosioc [2]; Istvan Borbath [3]; Ladislau Vekas [1]; Raul Alexandru Szakal [1]

[1] *Romanian Academy - Timisoara Branch*

[2] *University Politehnica Timisoara*

[3] *ROSEAL SA*

Innovative magneto-rheological (MR) devices for variable speed control of the hydraulic machines (e.g. pumps) are developed to ensure their flexible operation in the energy market [1]. A technical solution with MR clutch (MRC) for reducing the cavitational effects and improving the flow non-uniformity at the inlet of pumps is proposed [2]. Mechanical power from the input shaft of the electrical motor is transferred at constant speed to the outer output shaft of the hydraulic pump impeller. The MRC provides variable speed control for the inner output shaft linked with the inducer. An innovative solution of the MR clutch is designed to take into account both the technical requirements and the imposed geometric constraints. Selecting a ferrofluid based that was used in the MRC to meet the requirements is the key ingredient [3]. The highest ratio between the apparent viscosity of the MRF that ensures coupling when the magnetic field is applied and the lowest viscosity of the MRF without any applied magnetic field is the selection criterion. The improved properties of the MRF operating in a water environment should not be forgotten [4]. The concepts of the MRC and the technical solution are detailed. The test rig and experimental setup for assessing the performances of the MRC is presented. The conclusions of the experimental investigations are drawn in the last section paving the way to implementation in variable speed applications of hydraulic machines.

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