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Automotive Technical Paper

Characterization of Enhanced Magnetorheological Fluid Damper and Its Influence on Sustainable Hard Turning of SS410

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Abstract

Sustainable manufacturing, a term that has been used in the recent past on numerous occasions. A primary reason for it being in limelight, is that it does not cause any damage to the environment and also to the personal involved. Additionally, another important parameter of concern is the energy consumed during the machining process. One major reason for higher energy consumption is because of the presence of tool vibration. There have been several attempts made to reduce vibration and though they have been proved to be effective, they could be not classified under sustainable manufacturing. When used as a semi-active damper in metal cutting, magnetorheological fluid (MRF) has proven to be successful in vibration suppression. MRF is an intelligent non-Newtonian fluid that can change its viscosity instantly when a magnetic field is applied to it. They've utilised it as a damper in a number of areas because of this quality and its toughness. One significant drawback is the settling of magnetic particles floating in a non-magnetic fluid. When the current provided to the coil is increased, the settling rate becomes much worse. Increased current increases the amount of heat created in the coil, which heats the non-magnetic fluid and reduces its viscosity. Stabilizers are added to MRF to address this issue, and particle size has an immediate impact on settling. In this study, activated carbon and titanium were used as stabilisers, and the size of the magnetic particles was adjusted to see how it affected the viscosity of MRF. The testing results showed that adding stabilisers to MRF enhanced the viscosity and thus the cutting capability of SS410 steel during dry hard turning.

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