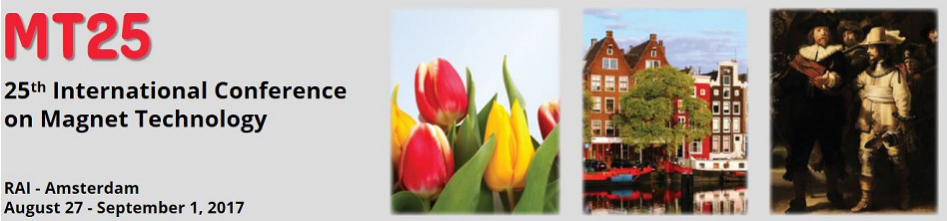

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FLUX-REGULATION PERFORMANCE FOR RADIAL SUSPENSION FORECES OF BEARINGLESS FLUX-SWITCHING MOTOR

Tuesday, 29 August 2017 13:15 (1h 45m)

Conventional bearingless PM motors usually suffer from the problems of mechanical integrity and thermal instability due to their PMs located in the rotor, which lead to a discount of the maximum electric loading performance. In order to solve the problems, the bearingless flux-switching permanent magnet (BFSPM) motors appear in recent years. BFSPM motor combines the characteristics of conventional FSPM motor and bearingless motor, which has the virtues of large torque capability, high radial suspension forces, simple rotor structure, strong robustness, easy thermal dissipation, etc. This structure of magnet-free rotor is favorable in application which requires frequent rotor disposal such as pumping of high-purity fluids, e.g. blood during medical operations. However, since the open-circuit air-gap flux is produced by the stator-magnets solely, it is difficult to be regulated. So the radial suspension force and torque can't be predicted accurately. Hence, in this paper, the flux-regulation capability of the BFSPM motor with four PM locations, namely PM-Full, PM-Top, PM-Middle and PM-Bottom are compared based on finite element analysis (FEA). According to the PM locations, four typical topologies of BFSPM motors are emerged, namely PM-full, PM-Bottom, PM-Middle, PM-Top, respectively. Based on these configurations, their flux-regulation performances for radial suspension forces are analyzed and compared by FEA. The analysis results show that the magnitude of radial suspension forces can be double at the PM-Bottom location if the PM length is halved when NdFeB is adopted. The PM-Middle and PM-Top configurations have almost the same magnitude of radial suspension forces. And the magnitude of radial suspension forces of PM-Middle has little difference from the PM-Top. The cause of this phenomenon will be discussed and analyzed in the full paper.

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