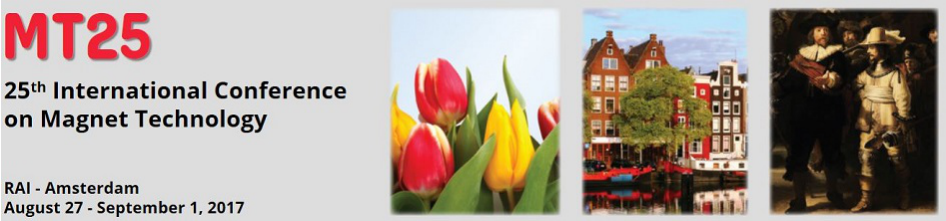

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Design of Dual-Channel Switched Reluctance Motor for Safety-Critical Applications Using Two 3-Phase Standard Inverters

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Switched reluctance machines are widely used in variety application in automotive, renewable energy, aerospace and domestic appliances sectors, due to its low cost, high torque capacity, simple and robust structure. In order to improve the reliability of SRM further, a dual-channel SRM (DCSRM) was proposed and their fault tolerant capacity was verified. However, the traditional topology of inverter is used, resulting in complicate construction. Meanwhile, the mutually coupled SRM (MCSRM) can be excited by sine-wave currents, and then the standard inverter can be adopted. Hence, this paper proposes a novel DCSRM using two 3-phase standard inverters. The key of proposed DCSRM is two operational models. In first operational model (Model I), it works like one 3-phase traditional SRM supplied by H-bridge inverter, which is drove by square-wave currents. In second operational model (Model II), it can be considered as two MCSRMs which are supplied by sine-wave currents. Model I is adopted for switching fault because the H-bridge inverter is adopt, which can keep the amplitude of the current under power switch fault and just change the direction of the current. Since the reluctance torque is not related with direction but amplitude of the current, the torque output will not reduce when power switch fault happens. Meanwhile, the Model II is employed for phase open-circuit fault. In sinusoids current supply model, when a phase is open, the currents of other two phases in fault channel are forced to be opposite. Then the neutral current is set to be zero. Since only two phases can work, the second and fourth order torque ripple cannot be neglected. In order to compensate the torque loss and torque ripple, the amplitudes of currents in healthy channel are set as a variable. Then, the proposed motor can be used to overcome different fault conditions.

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