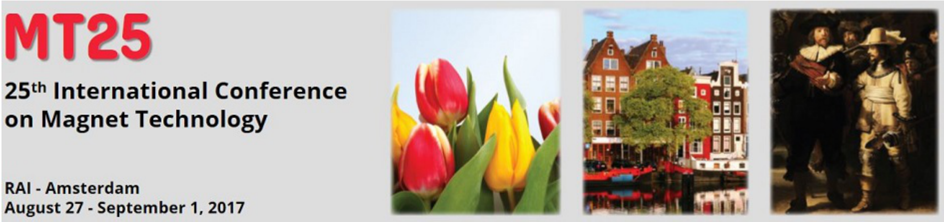

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Optimising rotor speed and design for an externally-mounted HTS dynamo

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

The HTS dynamo is a type of superconducting flux pump which employs a series of permanent magnets mounted upon a mechanical rotor. Interaction between flux from the rotor magnets and a coated conductor stator wire gives rise to a time-averaged DC emf, which is imposed across a series-connected superconducting coil. By employing a pair of soft ferromagnetic yokes, the device can be arranged such that all active moving parts are placed outside of the cryogenic environment. This minimises thermal losses and provides ease-of-access for maintenance. This arrangement offers great promise as an external 'brushless exciter' for next generation HTS generators and motors.A detailed numerical model of HTS dynamo operation is not presently available, so optimisation of these devices proceeds largely via empirical experiment. Here we report a detailed characterisation of the effect of rotor speed and magnet arrangement on the output performance of an experimental dynamo. Our results show that device performance is determined solely by the frequency at which magnets cross the stator, whilst being independent of the absolute speed. This is consistent with existing qualitative understanding of device operation. We further show that device output becomes unstable at very high rotor speeds. The threshold speed at which these instabilities emerge is systematically affected by the thermal coupling of the stator wire to the surrounding cryogenic environment.

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