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A Novel Switch Design for Compact HTS Flux Pumps

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High temperature superconducting (HTS) magnets have many potential applications, for instance, NMR/MRI, levitation systems, and high field applications. HTS magnets require a constant external current source to operate in CC mode. Flux pumps provide an alternative contact-less charging source that can inject flux into a closed-loop superconducting circuit. The simplicity of the rotating type flux pump makes it a popular choice. The rotating type flux pump operates as a DC voltage source with inherent resistance, Rd. From the literature review, it is evident that a lot of aspects of the HTS rotating type permanent magnet-based flux pump have been studied and certain aspects require further research.
The literature review shows that the design of the stator has major implications on the output capability of the flux pump. In this study, we have carried out the optimization of the rotating type flux pump by focusing on the stator design. Different stator designs have been studied. Factors, such as the number of stator tapes and the gap between the stator tapes, and their impact on the output capability of the rotating type flux pump have been analysed. Moreover, the open-circuit output voltage (Vdc), inherent resistance (Rd), and short circuit output current (Isc) have been analysed and compared for each design of the stator. We found that paralleling more stator tapes with appropriate gaps can be a promising design strategy to maximize the output capability for HTS rotating permanent magnets-based flux pump.

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