

The MEST, a new magnetic energy storage and transfer system: application studies to the European DEMO

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Abstract:

A new Magnetic Energy Storage and Transfer (MEST) system, which can improve the power handling in fusion experiments, has been recently conceived. It is particularly suitable to feed the DEMO Central Solenoid (CS), in principle without the need for resistive switching networks (SNUs), but can be applied to supply the Poloidal Field (PF) coils too. The operating principle of this system, described for one central solenoid circuit, is to pre-charge an additional Superconducting Magnetic Energy Storage (SMES) coil at least up to twice the maximum energy expected in the load (CS) and to transfer the energy from one to the other and viceversa via switched-capacitor. With this approach, the energy is exchanged between the load and the storage system, thus flattening the active power profile to be required from the ac side and substantially nullify the reactive power absorbed. In this paper, the application of this concept to the European DEMO is studied, starting from the present circuit configuration and from the current and voltage scenario under consideration for the plasma breakdown and ramp-up. A first tentative rating of the system components is reported, discussing also the future R&D steps to explore the industrial feasibility of such a scheme.