

Design of an electrical machine with integrated flywheel

Colotti Alberto
Reichert Konrad, Prof. Dr.-Ing. habil.
ETH Zurich
ETH Zentrum
8092 Zurich, Switzerland
++41 1 632 64 02
colotti@iem.ee.ethz.ch
<http://www.iem.ee.ethz.ch/>

von Burg Peter , Dr. sc. tech. ETH
ASPES AG
PO Box
8033 Zurich, Switzerland
++41 1 363 10 43
pvonburg@aspes.ch
<http://www.aspes.ch/>

A kinetic energy storage unit has been optimised regarding energy content, power and losses within the machine. The machine design is a permanent magnet synchronous machine with an outer rotor arranged as a Halbach array. This design minimises the losses particularly within the rotor. The stator losses are reduced to the mere copper losses. The outer rotor has been integrated into the flywheel, forming one unit instead of a machine with an attached flywheel. Thus the air gap circumferential speed of the machine may reach higher values than usually. The torque of the machine is calculated dependent on the geometry and the magnetic flux. In the presented version the power of the machine has been optimised, considering the electromagnetic parameters and the rotor strength both together. The highest power can not be combined with the highest possible energy density. Therefore depending on the requirements other design goals like energy density or energy to power ratio must be taken into account for a total design optimisation as well. The burst behaviour of the rotor has been considered as another main design criteria. A proper design of the composite rotor helps to reduce the forces onto the containment to an acceptable level.