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Book Group Author(s): IEEE

Title: Predictive Optimal Matrix Converter Control for a Dynamic Voltage Restorer with Flywheel Energy Storage

Source: IECON: 2009 35th Annual Conference of IEEE Industrial Electronics, VOLS 1-6: 707-712 2009

Language: English

Document Type: Proceedings Paper

Conference Title: 35th Annual Conference of the IEEE-Industrial-Electronics-Society (IECON 2009)

Conference Date: NOV 03-05, 2009

Conference Location: Porto, PORTUGAL

Conference Sponsors: IEEE Ind Elect Soc.

KeyWords Plus: VECTOR

Abstract: This paper presents a predictive optimal matrix converter controller for a flywheel energy storage system used as Dynamic Voltage Restorer (DVR). The flywheel energy storage device is based on a steel seamless tube mounted as a vertical axis flywheel to store kinetic energy. The motor/generator is a Permanent Magnet Synchronous Machine driven by the AC-AC Matrix Converter. The matrix control method uses a discrete-time model of the converter system to predict the expected values of the input and output currents for all the 27 possible vectors generated by the matrix converter. An optimal controller minimizes control errors using a weighted cost functional. The flywheel and control process was tested as a DVR to mitigate voltage sags and swells. Simulation results show that the DVR is able to compensate the critical load voltage without delays, voltage undershoots or overshoots, overcoming the input/output coupling of matrix converters.

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Publisher: IEEE

Publisher Address: 345 E 47TH ST, NEW YORK, NY 10017 USA

ISBN: 978-1-4244-4648-3

ISI Document Delivery No.: BQE04