Abstract Submitted
for the NWS14 Meeting of
The American Physical Society

Design Considerations for Implementing Halbach Arrays and High Temperature Superconductors for Contact-Free Flywheel Energy Storage Systems CHRISTOPHER MIRABZADEH, CHRIS BIRKINBINE, DANIEL SCHNEIDER, JOE LAW, CHRISTINE BERVEN, University of Idaho — We have investigated the use of Halbach magnet arrays in combination with Type II High-Temperature Superconductors for use as a levitating thrust bearing for a fly-wheel energy storage system. Halbach arrays were selected because they have effectively one-sided flux and a greater flux gradient which would be expected to result in a greater levitation force and effective restoring force stiffness; each being beneficial in the design of such a system. To find the optimum orientation of the magnets for the arrays, we used Infolytica Magnet, a finite-element computation software package, to iterate over all permutations of magnet arrays costing of 3 and 5 magnets of single and double layers. The fields and levitation forces as well as the width of the magnet arrays relative to the width of the superconductor were analyzed. Within our given design constraints, we found that, compared to a single magnet, a single-pole Halbach array was predicted to increase levitation force and stability, reduce stray fields, focus the flux, and increase the bearing stiffness. We present our findings and suggest guidelines to increase levitation force of a superconducting magnetic bearing with qualifiers and rationale for optimizing such a system.

Christopher Mirabzadeh
University of Idaho

Date submitted: 22 Mar 2014 Electronic form version 1.4