A topology optimized switchable permanent magnet system

The design of a magnetic field source that can switch from a high field to a low field configuration by rotation by 90°90° of a set of iron pieces is investigated using topology optimization. A Halbach cylinder is considered as the magnetic field source and iron inserts are placed in the air gap of the Halbach cylinder. The ideal shape of these iron inserts is determined as function of the field generated by the Halbach cylinder and as function of the size of the iron segments. The topology optimized structures are parabolic shaped pieces and have a difference in flux density between the high and low positions that is on average 1.29 times higher than optimized regular pole pieces. The maximum increase is a factor of 2.08 times higher than the regular pole pieces.
Web of Science (2014): Impact factor 1.97
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.03 SJR 0.801 SNIP 1.385
Web of Science (2013): Impact factor 2.002
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.95 SJR 0.928 SNIP 1.294
Web of Science (2012): Impact factor 1.826
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.84 SJR 1.07 SNIP 1.275
Web of Science (2011): Impact factor 1.78
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.936 SNIP 0.987
Web of Science (2010): Impact factor 1.69
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.844 SNIP 0.908
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.867 SNIP 0.903
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.711 SNIP 0.844
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.838 SNIP 0.882
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.699 SNIP 0.692
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.811 SNIP 1.044
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.051 SNIP 0.957
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.233 SNIP 1.143
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.209 SNIP 0.978
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.832 SNIP 0.936
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.875 SNIP 0.912
Original language: English
Keywords: Topology optimization, Halbach cylinder, Magnetic field, Permanent magnet flux sources, Switchable field source
DOIs: 10.1016/j.jmmm.2018.05.076
Source: FindIt
Source-ID: 2434827976
Research output: Research - peer-review > Journal article – Annual report year: 2018
Quantum heat engines: Limit cycles and exceptional points

We show that the inability of a quantum Otto cycle to reach a limit cycle is connected with the propagator of the cycle being noncompact. For a working fluid consisting of quantum harmonic oscillators, the transition point in parameter space where this instability occurs is associated with a non-Hermitian degeneracy (exceptional point) of the eigenvalues of the propagator. In particular, a third-order exceptional point is observed at the transition from the region where the eigenvalues are complex numbers to the region where all the eigenvalues are real. Within this region we find another exceptional point, this time of second order, at which the trajectory becomes divergent. The onset of the divergent behavior corresponds to the modulus of one of the eigenvalues becoming larger than one. The physical origin of this phenomenon is that the hot and cold heat baths are unable to dissipate the frictional internal heat generated in the adiabatic strokes of the cycle. This behavior is contrasted with that of quantum spins as working fluid which have a compact Hamiltonian and thus no exceptional points. All arguments are rigorously proved in terms of the systems' associated Lie algebras.
Two level undercut-profile substrate-based filamentary coated conductors produced using metal organic chemical vapor deposition

The two level undercut-profile substrate (2LUPS) has been introduced as a concept for subdividing rare-earth-Ba$_2$Cu$_3$O$_7$ (REBCO) coated conductors (CC) into narrow filaments which reduces the AC losses and improves field stability for DC magnets. The 2LUPS consists of two levels of plateaus connected by a wall with an undercut-profile, which enables a physical separation of the superconducting layer between the plateaus without reducing the effective width of the superconducting layer. In this study we report for the first time the results of fabrication and characterization of a filamentary CC produced in an industrial setup by SuperPower Inc. using ion beam assisted deposition and metal organic chemical vapor deposition (IBAD-MOCVD) on a 2LUPS substrate realized at the Technical University of Denmark (DTU), whereas previous studies discussed the fabrication using alternating beam assisted deposition and pulsed laser deposition (ABAD-PLD). We also present Hall probe scanning measurements performed using a standard TAPESTAR® XL machine that is routinely employed for industrial critical current characterization of long length CCs. It clear that additional analysis of the measured field profiles are required when characterizing filamentary 2LUPS CC using a standard TAPESTAR® setting. Using FEM we calculated the expected magnetization response and we find a good agreement.

General information
State: Published
Number of pages: 5
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: IEEE Transactions on Applied Superconductivity
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Article number: 6601705
ISSN (Print): 1051-8223
Ratings:
BFI (2019): BFI-level 1
Design, enhanced Thermal and Flow efficiency of a 2KW active magnetic regenerator

The goal of the Danish ENOVHEAT project is to design and realize a high-efficiency magnetocaloric heat pump for the residential sector, based on the active magnetic regenerator (AMR) technology. Such a heat pump should have a coefficient of performance (COP) of at least 5, while giving a heating power of 1500 W over a temperature span of 25 K. This paper explains several details of the device, such as the design of the magnet, the regenerator housing and the flow system. In particular, this paper investigates the best geometry for the regenerator bed to achieve a thermal and mechanically efficient housing to be used in the AMR system. Particular attention has been given to the reduction of the parasitic losses through the regenerator housing: both heat leaks between the magnetocaloric material (MCM) and an adjacent iron ring and the surroundings through a lid on top of the regenerator. These quantities have been decreased by creating an embossment on the bottom surface of the regenerator and by placing a thin rubber sheet between the magnetocaloric material and the steel lid, respectively.

Reply to “Comment on 'Performance of Halbach magnet with finite coercivity’”

We reply to Dr. Xu’s comment on our paper ‘Performance of Halbach magnet arrays with finite coercivity’ (JMMM 407 (2016), 369-376). Contrary to Dr. Xu’s objections we show that the procedure employed by us correctly accounts for the shape effects of the magnet elements. We show that the partial differential equation for the magnetic vector potential, derived from the Maxwell equations, incorporates all shape effects. On the other hand, the local constitutive relations express a point-wise link between, e.g., magnetic field and magnetic flux density, and are as such independent of geometry. We confirm that the results of our computations are perfectly consistent with the constitutive relation which is assumed as starting point.
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes

BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.97 SJR 0.786 SNIP 1.349
Web of Science (2017): Impact factor 3.046
Web of Science (2017): Indexed yes

BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.41 SJR 0.699 SNIP 1.181
Web of Science (2016): Impact factor 2.63
Web of Science (2016): Indexed yes

BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.33 SJR 0.73 SNIP 1.296
Web of Science (2015): Impact factor 2.357
Web of Science (2015): Indexed yes

BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.07 SJR 0.815 SNIP 1.423
Web of Science (2014): Impact factor 1.97
Web of Science (2014): Indexed yes

BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.03 SJR 0.801 SNIP 1.385
Web of Science (2013): Impact factor 2.002
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes

BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.95 SJR 0.928 SNIP 1.294
Web of Science (2012): Impact factor 1.826
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes

BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.84 SJR 1.07 SNIP 1.275
Web of Science (2011): Impact factor 1.78
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes

BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.936 SNIP 0.987
Web of Science (2010): Impact factor 1.69
Web of Science (2010): Indexed yes

BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.844 SNIP 0.908
Web of Science (2009): Indexed yes

BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.867 SNIP 0.903
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.711 SNIP 0.844
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.838 SNIP 0.882
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.699 SNIP 0.692
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.811 SNIP 1.044
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.051 SNIP 0.957
Web of Science (2003): Indexed yes
Topology optimized permanent magnet systems

Topology optimization of permanent magnet systems consisting of permanent magnets, high permeability iron and air is presented. An implementation of topology optimization for magnetostatics is discussed and three examples are considered. The Halbach cylinder is topology optimized with iron and an increase of 15% in magnetic efficiency is shown. A topology optimized structure to concentrate a homogeneous field is shown to increase the magnitude of the field by 111%. Finally, a permanent magnet with alternating high and low field regions is topology optimized and a $\Lambda_{\text{cool}}$ figure of merit of 0.472 is reached, which is an increase of 100% compared to a previous optimized design.

General information

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Contributors: Bjørk, R., Bahl, C., Insinga, A. R.
Pages: 78-85
Publication date: 2017
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Publication information

Journal: Journal of Magnetism and Magnetic Materials
Volume: 437
ISSN (Print): 0304-8853
Ratings:
Scopus rating (2012): SJR 1.233 SNIP 1.143
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 1.209 SNIP 0.978
Web of Science (2011): Indexed yes
Scopus rating (2010): SJR 0.832 SNIP 0.936
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 0.875 SNIP 0.912
Original language: English
Keywords: Electronic, Optical and Magnetic Materials, Condensed Matter Physics, Demagnetization, Halbach magnet, Reversal of remanence, Coercive force, Magnetism, Maxwell equations, Constitutive relations, Halbach magnet array, Halbach magnets, Magnetic vector potentials, Point wise, Shape effect, Magnets
DOIs:
10.1016/j.jmmm.2016.11.085
Source: FindIt
Source-ID: 2349333724
Research output: Research › Comment/debate – Annual report year: 2016
Generating the optimal magnetic field for magnetic refrigeration

In a magnetic refrigeration device the magnet is the single most expensive component, and therefore it is crucially important to ensure that an effective magnetic field as possible is generated using the least amount of permanent magnets. Here we present a method for calculating the optimal remanence distribution for any desired magnetic field. The method is based on the reciprocity theorem, which through the use of virtual magnets can be used to calculate the optimal remanence distribution. Furthermore, we present a method for segmenting a given magnet design that always results in the optimal segmentation, for any number of segments specified. These two methods are used to determine the optimal magnet design of a 12-piece, two-pole concentric cylindrical magnet for use in a continuously rotating magnetic
Globally Optimal Segmentation of Permanent-Magnet Systems

Permanent-magnet systems are widely used for generation of magnetic fields with specific properties. The reciprocity theorem, an energy-equivalence principle in magnetostatics, can be employed to calculate the optimal remanent flux density of the permanent-magnet system, given any objective functional that is linear in the magnetic field. This approach, however, yields a continuously varying remanent flux density, while in practical applications, magnetic assemblies are realized by combining uniformly magnetized segments. The problem of determining the optimal shape of each of these segments remains unsolved. We show that the problem of optimal segmentation of a two-dimensional permanent-magnet assembly with respect to a linear objective functional can be reduced to the problem of piecewise linear approximation of a plane curve by perimeter maximization. Once the problem has been cast into this form, the globally optimal solution can be easily computed employing dynamic programming.
Optimally segmented magnetic structures

We present a semi-analytical algorithm for magnet design problems, which calculates the optimal way to subdivide a given design region into uniformly magnetized segments. The availability of powerful rare-earth magnetic materials such as Nd-Fe-B has broadened the range of applications of permanent magnets[1][2]. However, the powerful rare-earth magnets are generally expensive, so both the scientific and industrial communities have devoted a lot of effort into developing suitable design methods. Even so, many magnet optimization algorithms either are based on heuristic approaches[3], or are applicable only to analytically solvable geometries[4]. In addition, some questions remained fundamentally unanswered, such as how to segment a given design into N uniformly magnetized pieces. Our method calculates the globally optimal shape and magnetization direction of each segment inside a certain design area with an optional constraint on the total amount of magnetic material. The method can be applied to any objective functional which is linear with respect to the field, and with any combination of linear materials. Being based on an analytical-optimization approach, the algorithm is not computationally intensive and provides the global optimum with respect to the considered problem without the need for a starting guess. The approach can be used in combination with finite element method calculations, and can therefore be applied also to problems for which an analytical solution to the magnetic field is not available. We will illustrate the results for magnet design problems from different areas, such as electric motors/generators (as the example in the picture), beam focusing for particle accelerators and magnetic refrigeration devices.

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Contributors: Insinga, A. R., Bahl, C., Bjørk, R., Smith, A.
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Peer-reviewed: Yes
Event: Abstract from 13th Joint MMM-Intermag Conference, San Diego, CA, United States.
Keywords: Segmentation, Optimization, Analytical, FEM

Optimally segmented permanent magnet structures

We present an optimization approach which can be employed to calculate the globally optimal segmentation of a two-dimensional magnetic system into uniformly magnetized pieces. For each segment the algorithm calculates the optimal shape and the optimal direction of the remanent flux density vector, with respect to a linear objective functional. We illustrate the approach with results for magnet design problems from different areas, such as a permanent magnet electric motor, a beam focusing quadrupole magnet for particle accelerators and a rotary device for magnetic refrigeration.

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Volume: 52
Issue number: 12
Article number: 7210306
ISSN (Print): 0018-9464
Ratings:

BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.82 SJR 0.488 SNIP 1.039
Web of Science (2017): Impact factor 1.467
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.51 SJR 0.653 SNIP 0.949
Web of Science (2016): Impact factor 1.243
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.77 SJR 0.575 SNIP 1.21
Web of Science (2015): Impact factor 1.277
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.68 SJR 0.696 SNIP 1.464
Web of Science (2014): Impact factor 1.386
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.75 SJR 0.587 SNIP 1.395
Web of Science (2013): Impact factor 1.213
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.89 SJR 0.769 SNIP 1.55
Web of Science (2012): Impact factor 1.422
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.69 SJR 0.818 SNIP 1.409
Web of Science (2011): Impact factor 1.363
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.712 SNIP 1.134
Web of Science (2010): Impact factor 1.053
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.735 SNIP 1.182
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.911 SNIP 1.236
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.764 SNIP 1.196
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.905 SNIP 1.231
Scopus rating (2005): SJR 1.027 SNIP 1.245
Scopus rating (2004): SJR 0.816 SNIP 1.122
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.086 SNIP 1.127
Scopus rating (2002): SJR 1.035 SNIP 1.064
Optimising Magnetostatic Assemblies

The aim of this thesis is to investigate a framework to design and optimise magnetostatic systems. Over the course of the last decades the range of applications of permanent magnets expanded considerably, thanks to the development of powerful rare-earth permanent magnets. Concurrently, the research on methods to optimise permanent magnet based magnetic systems intensified. The increase in computational power, and the emergence of new optimisation algorithms provided new instruments for the design of magnetic systems. All these factors contribute in making the optimisation of magnetic systems a very lively sector of modern research.

The main focus of this work are magnetic systems based on permanent magnets, although hybrid systems combining permanent magnets with electromagnets are also considered. Many optimisation approaches presented here are derived within a framework based on the reciprocity theorem. This theorem formulates an energy equivalence principle with several implications concerning the optimisation of objective functionals that are linear with respect to the magnetic field. Linear functionals represent different optimisation goals, e.g. maximising a certain component of the field averaged over a region of space. In general, a linear functional can be expressed as the integral over a given region of the scalar product between the magnetic field and an arbitrarily defined objective vector field. It has been known for some time that the reciprocity theorem can be used to determine the optimal remanence distribution with respect to a linear objective functional. Additionally, it is shown here that the same formalism can be applied to the optimisation of the geometry of magnetic systems. Specifically, the border separating the permanent magnet from regions occupied by air or soft magnetic material can be optimised within this framework. Since in the practice most structures are realized by assembling uniformly magnetized pieces of permanent magnet, it is relevant to address the question of how a given region of space is best subdivided. This problem is investigated here within the framework of the reciprocity theorem. Analytical derivations will be used to show that, for segmentations controlled by a single parameter, the globally optimal solution to this problem can be determined for almost arbitrary geometries. The case of segmentations depending by two parameters has been approached employing a heuristic algorithm, which led to new design concepts. Some of the procedures developed for linear objective functionals have been extended to non-linear objectives, by employing iterative techniques. Even though most of the optimality results discussed in this work have been derived analytically, the different approaches have been implemented in combination with finite element methods, resulting in flexible and computationally efficient algorithms. Most of the optimisation approaches could only be proven under the assumption of linear magnetic behavior. The last part of this thesis also investigates some of the effects on the performance of magnetic systems, due to non-linear magnetic phenomena. In particular, the non-linear demagnetization effects caused by the finite coercivity of the permanent magnet material will be examined. All the optimisation techniques will be illustrated with example magnetic systems for different applications, thus showing the versatility and efficacy of the various approaches. The Halbach cylinder geometry, relevant for many applications, will be often used as example, also because of the many symmetries and optimality properties exhibited by this geometry. Despite the fact that this system has already been subject of many publications, some of the aspects considered in this thesis have not been investigated before. The ultimate goal of the PhD project is to apply the optimisation techniques developed during this research to the design of the magnetic system for the prototype of heat pump based on the magnetocaloric effect. Magnetic systems for room temperature magnetic refrigeration will thus frequently be used as illustrative examples along the course of this thesis. Primarily because of the theoretical relevance of linear functionals, the results presented here lead to a deeper understanding of the magnet optimisation process. One of the perspectives considered in this work is the trade-off between field intensity and field quality, as the choice of a particular optimisation approach may favour one or the other. The general framework discussed here provides a set of useful tools aiding the magnet design process. This research also opened new scientific questions which would be worth investigating in future studies.

General Information
Performance of Halbach magnet arrays with finite coercivity
A numerical method to study the effect of finite coercivity on the Halbach cylinder geometry is presented. Despite the fact that the analytical solution available for this geometry does not set any limit to the maximum air gap flux density achievable, in real life the non-linear response of the magnetic material and the fact that the coercivity is not infinite will limit the attainable field. The presented method is able to predict when and where demagnetization will occur, and these predictions are compared with the analytical solution for the case of infinite coercivity. However, the approach presented here also allows quantification of the decrease in flux density and homogeneity for a partially demagnetized magnet. Moreover, the problem of how to realize a Halbach cylinder geometry using a mix of materials with different coercivities without altering the overall performance is addressed. Being based on a numerical approach, the presented method can be employed to analyze the demagnetization effects due to coercivity for any geometry, even when the analytical solution is not available.

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Original language: English
Electronic versions: Optimising Magnetostatic Assemblies

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Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.97 SJR 0.786 SNIP 1.349
Web of Science (2017): Impact factor 3.046
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.41 SJR 0.699 SNIP 1.181
Web of Science (2016): Impact factor 2.63
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.33 SJR 0.73 SNIP 1.296
Web of Science (2015): Impact factor 2.357
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.07 SJR 0.815 SNIP 1.423
Web of Science (2014): Impact factor 1.97
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Design and experimental tests of a rotary active magnetic regenerator prototype

A rotary active magnetic regenerator (AMR) prototype with efficiency and compact design as focus points has been designed and built. The main objective is to demonstrate improved efficiency for rotary devices by reducing heat leaks from the environment and parasitic mechanical work losses while optimizing the utilization of the magnetized volume. Heat transfer calculations combined with 1D AMR modeling have revealed the necessity for an insulating air gap between magnet and regenerator when designing for high efficiency. 2D finite difference AMR modeling capturing the interplay between heat transfer fluid flow and an inhomogenous time-varying magnetic field in the individual regenerator beds has...
been used in the design process. For one operating point a COP of 3.1 at a temperature span of 10.2 K and a cooling power of 103 W were measured. Major issues limiting the performance have been identified and improvements are outlined for future work. © 2015 Elsevier Ltd and IIR. All rights reserved.

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Organisations: Department of Energy Conversion and Storage, Electrofunctional materials
Contributors: Eriksen, D., Engelbrecht, K., Bahl, C., Bjørk, R., Nielsen, K. K., Insinga, A. R., Pryds, N.
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Journal: International Journal of Refrigeration
Volume: 58
ISSN (Print): 0140-7007
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.46 SJR 1.471 SNIP 1.888
Web of Science (2017): Impact factor 3.233
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.06 SJR 1.371 SNIP 1.607
Web of Science (2016): Impact factor 2.779
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.44 SJR 1.349 SNIP 1.532
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.6 SJR 1.619 SNIP 2.086
Web of Science (2014): Impact factor 2.241
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.25 SJR 1.422 SNIP 1.944
Web of Science (2013): Impact factor 1.702
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.09 SJR 1.386 SNIP 1.893
Web of Science (2012): Impact factor 1.793
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 2.2 SJR 1.272 SNIP 2.129
Web of Science (2011): Impact factor 1.817
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.355 SNIP 1.789
Web of Science (2010): Impact factor 1.439
Web of Science (2010): Indexed yes
Effect of Temperature Step Size on Calculating the Magnetic Entropy Change

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Electrofunctional materials, Secretariat, IT
Contributors: Neves Bez, H., Insinga, A. R., Nielsen, K. K., Smith, A., Bahl, C. R.
Number of pages: 1
Publication date: 2015
Peer-reviewed: No

Electronic versions:
Effect_of_Temperature_Step.pdf

Research output: Research - peer-review › Journal article – Annual report year: 2015

Experimental Studies with an Active Magnetic Regenerating Refrigerator

Experimental results for an active magnetic regenerator (AMR) are presented. The focus is on whether or not it pays off to partly substitute soft magnetic material with non-magnetic insulation in a flux-conducting core in the magnet system. Such a substitution reduces losses due to heat conduction and eddy currents, but also reduces the magnetic field. Two different cores were tested in the AMR system with different cooling loads and it is shown, that in the present case, replacing half of the iron with insulation lead to an average reduction in temperature span of 14%, but also a small decrease in COP, hence the substitution did not pay off. Furthermore, it is shown experimentally, that small imbalances in the heat transfer fluid flow greatly influence the system performance. A reduction of these imbalances through valve adjustments resulted in an increase in the temperature span from approximately 16 K to 27.3 K.

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Publication date: 2015

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Publisher: International Institute of Refrigeration
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812.pdf
Performance-oriented Analysis of a Hybrid magnetic Assembly for a Heat-pump Magnetocaloric Device

Conventional active-regenerator magnetocaloric devices include moving parts, with the purpose of generating an oscillating magnetic field in the magnetocaloric material, placed inside the regenerator. In this work a different design is analyzed, for application in a magnetocaloric heat pump. In this design all the parts of the machine are static and the oscillating field is generated by varying the currents of electromagnets included in the hybrid magnetic assembly. The use of different permanent magnet materials is compared with the perspective of maximizing the coefficient of performance of the device.

General information
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Organisations: Department of Energy Conversion and Storage, Electrofunctional materials
Contributors: Insinga, A. R., Smith, A., Bahl, C. R., Bjørk, R.
Number of pages: 2
Publication date: 2014

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Title of host publication: Proceedings of the 6th IIF-IIR international Conference on Magnetic Refrigeration
Publisher: International Institute of Refrigeration
Electronic versions:
Performance_oriented_Analysis.pdf
Research output: Research - peer-review › Article in proceedings – Annual report year: 2014

Projects:

Harvesting Energy with Levitating Magnets
Imbaquingo Muñoz, C. E., PhD Student, Department of Energy Conversion and Storage
Bjørk, R., Main Supervisor, Department of Energy Conversion and Storage
Bahl, C., Supervisor, Department of Energy Conversion and Storage
ATOMIS: Advanced tailoring of 3D microstructures for superconducting magnets

Superconducting magnets capable of producing large magnetic fields are indispensable for magnetic resonance imaging (MRI) for medical diagnostics. The higher the field is, the higher the spatial resolution achievable in the scanner is; this is crucial for the early detection of, e.g., cancer tumors. The present research project focuses on a new concept for the superconducting magnet which will enable an increase in the magnetic field by a factor of more than three. This is done by using ceramic superconductors in combination with a novel substrate configuration recently developed by the applicant. The substrate makes it possible to produce many thin superconducting 3D structured filaments instead of a single wide conductor, thus increasing the field produced and improving the resolution of the MRI device. The project aims to solve the scientific problems currently impeding the achievement of sufficiently small filaments. A major scientific problem is related to oxygen formation and spread during electro-etching of 3D profiles resulting in undesired structural filament variations.

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Project ID: DFF – 6111-00252
01/01/2017 → 01/01/2019

Keywords: surface modification, electrochemistry, topography, Coated conductor, Superconductor, ceramic processing
Collaborators: Bruker BioSpin GmbH, Germany, University of Bratislava

Optimised Hybrid Magnets

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Lomonova, E. A., Examiner

Forskningsrådsfinansiering
01/06/2013 → 16/11/2016

Award relations: Optimised Hybrid Magnets
Project: PhD

Activities:

Delft Days on Magnetocalorics 2015
Period: 2 Nov 2015 → 3 Nov 2015
Andrea Roberto Insinga (Participant)

Department of Energy Conversion and Storage
Electrofunctional materials

Related event

Delft Days on Magnetocalorics 2015
02/11/2015 → …
Delft, Netherlands
Activity: Attending an event › Participating in or organising a conference

European School of Magnetism
Period: 24 Aug 2015 → 4 Sep 2015
Andrea Roberto Insinga (Participant)

Department of Energy Conversion and Storage
Electrofunctional materials

**Description**
From fundamental magnetism to spin currents

**Related event**

**European School of Magnetism**
24/08/2015 → 04/09/2015
Cluj-Napoca, Romania

Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.