超電導エネルギー貯蔵研究会

SMES関連論文情報
（平成29年度版）

平成30年7月

技術委員会

目　　次

１．調査範囲

データベースに入力する情報は、以下の調査範囲を基本として調査・収集する。

① 海外情報を基本とする。但し、トピックス的な情報については国内のものも調査する。

② 超電導全般について調査をするが、ＳＭＥＳあるいは現在開発中のプロジェクト関連の情報に重点を置く。

③ 上記以外については、研究開発の現状、動向あるいは政府の施策などが分かるもの、 集約されたものを収集する（例えば､材料でチャンピオンデータ等が整理されているものなど）。

④ 特許関連については対象外とする。

２．調査項目

データベースからの検索、データの利用を考えて、情報は以下の８項目について整理する。

① 国名

② 情報の種類、内容（３分類）

分類１（情報分類）	分類２（用途）	分類３（要素技術）
１：技術論文 ２：技術解説・展望 ３：研究開発動向 ４：企業動向 ５：政府・団体・学会動向	１：電力貯蔵 ２：出力設備 ３：輸送設備 ４：核融合・MHD・加速器・医療等 ５：デバイス ６：材料・製法 ７：超電導全般	１：コイル ２：断熱支持 ３：He、真空容器 ４：冷却システム ５：電力変換システム ６：土木構造 ７：磁気シールド ８：ケーブル、導線 ９：計測、制御 10：経済性 11：その他

③ 著者

④ タイトル

⑤ 出典

⑥ 発行年月日

⑦ 掲載ページ

⑧ 概要

３．調査対象

（１）平成２６～２８年に発行された国際会議の論文

（２）国内外の主要学会誌

（３）政府関連の報告書

（４）企業、大学の刊行物

（５）その他

４．入力件数

過去及び本年度の入力数は下記の通り。

	外国情報	国内情報	計
平成2年度	195	158	353
平成3年度	191	96	287
平成4年度	138	24	162
平成5年度	94	58	152
平成6年度	121	77	198
平成7年度	81	11	92
平成8年度	77	129	206
平成9年度	72	47	119
平成10年度	13	47	60
平成11年度	16	44	60
平成12年度	20	37	57
平成13年度	2	25	27
平成14年度	1	14	15
平成15年度	0	11	11
平成16年度	4	13	17
平成17年度	9	42	51
平成18年度	6	39	45
平成19年度	25	23	48
平成20年度	45	15	60
平成21年度	30	9	39
平成22年度	46	12	58
平成23年度	32	10	42
平成 24 年度	45	18	63
平成 25 年度	18	8	26
平成 26 年度	16	6	22
平成 27 年度	30	7	37
平成 28 年度	30	8	38
平成 29 年度	27	6	33
合計	1384	994	2378

出力一覧

▫平成２９年度入力分
No.2346　～　2378
全項目について出力

整理番号	2346	中国	
分類1	1	1	1
著者	A Study on the Design and Comparison of 1–100–MJ–Class SMES Magnet With Different Coil Configurations		
タイトル	Ying Xu, Li Ren, Yuejin Tang, Chen Xu, Zhongping Zhang, Wei Chen, Jingdong Li, Jing Shi, and Lei Chen		
出典	IEEE TRANS. APPL. SUPERCOND., VOL. 27, NO. 5		
発行年	2017	PAGE. 5700809	
概要	The MJ–class superconducting magnetic energy storage system (SMES) is most likely put into commercial utility applications. In China, several 1–100–MJ–class high–temperature superconducting (HTS) SMES projects are undergoing preresearch and conceptual design stage by the government and the power grid corporations, and these SMESs will be developed later. The configurations of commonly used SMES magnets are single–solenoid, multiple–solenoid, and toroidal magnets. Each configuration has its own electromagnetic and mechanical characteristics. In this paper, an optimal design and comparison were carried out to		

整理番号	2347	中国	
分類1	1	1	11
著者			
タイトル	Design and Evaluation of a Mini–Size SMES Magnet for Hybrid Energy Storage Application in a kW–Class Dynamic Voltage Restorer		
出典	IEEE TRANS. APPL. SUPERCOND., VOL. 27, NO. 5		
発行年	2017	PAGE. 5700911	
概要	This paper presents the design and evaluation of a mini–size GdBCO magnet for hybrid energy storage (HES) application This paper presents the design and evaluation of a mini–size GdBCO magnet for hybrid energy storage (HES) application in a kW–class dynamic voltage restorer (DVR). The HESbased DVR concept integrates with one fast–response high–power superconducting magnetic energy storage (SMES) unit and one low–cost high–capacity battery energy storage (BES) unit. Structural design, fabrication process, and finite–element–modeling simulation of a 3.25 mH/240 A SMES magnet wound by state–of–theart GdBCO tapes in SuNAM are presented. To avoid the internal soldering junctions and		

整理番号	2348	中国	
分類1	1	1	1
著者	Lei Chen , Member, IEEE, Hongkun Chen, Jun Yang, Huiwen He, Yanjuan Yu, Guocheng Li , Ying Xu , Zuoshuai Wang, and Li Ren		
タイトル	Conceptual Design and Evaluation of an HTS Magnet for an SMES Used in Improving Transient Performance of a Grid–Connected PV System		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 3,		
発行年	2018	PAGE. 4600708	
概要	This paper suggests a small–scale superconducting magnetic energy storage (SMES) to enhance the transient behaviors of a 100kWgrid–connected photovoltaic (PV) system, and conducts the conceptual design and performance evaluation. Considering the PV system requirements, the stored energy of the SMES is 90 kJ, and theYBCOtapes are adopted to make a solenoid SMES magnet. Based on the genetic algorithm, the magnet parameters including critical current, tape length, parallel and perpendicula magnetic fields are optimized. Using simulation tools, the effects of the SMES on the PV system are assessed, and the electromagnetic properties, stress, and loss of the SMES magnet are analyzed. The		

整理番号	2349	中国	
分類1	1	1	11
著者	Lei Chen , Hongkun Chen, Yanhong Li, Guocheng Li , Jun Yang, Xin Liu, Ying Xu , Li Ren , and Yuejin Tang		
タイトル	SMES–Battery Energy Storage System for the Stabilization of a Photovoltaic–Based Microgrid		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4,		
発行年	2018	PAGE. 5700407	
概要	As superconducting magnetic energy storage (SMES) and battery are complem entary in their technical properties of power capacity, energy density, response speed, etc., this paper proposes an SMES–battery energy storage system to stabilize a photovoltaic–based microgrid under different faults. The related theoretical modeling is stated, and the control and coordination methods of the SMES–battery are put forward. Using MATLAB, a comparison of with the SMES–battery and only with the battery is carried out. From the main specifications of the SMES magnet, the ac–loss calculation is also performed. The results show that i) the SMES–battery is better than the battery to timely deal with the transient		

整理番号	2350	日本	
分類1	1	1	1
著者	Shinya Mizuno, Tsuyoshi Yagai , Toru Okubo, Sora Mizuochi, Masahiro Kamibayashi, Mana Jinbo, Tomoaki Takao , Yasuhiro Makida, Takakazu Shintomi, Naoki Hirano, Toshihiro Komagome, Kenichi Tsukada, Taiki Onji , Yuki Arai, Masaru Tomita, Daisuke Miyagi, Makoto Tsuda , and Takataro Hamajima		
タイトル	Feasibility Study of MgB2 Cable for Pancake Coil of Energy Storage Device		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 3,		
発行年	2018	PAGE. 4602505	
概要	Abstract—Superconducting magnetic energy storage (SMES) devices of several tens of kJ class are generally suitable for voltage compensation for microgrids, which produce and distribute electric power to restricted areas. MgB2 material has been developed with superconducting properties by decreasing the production cost. Since hydrogen energy would be widely utilized to realize society with low carbon emission and stored in liquid state for reducing its volume, the power distribution system consisting of MgB2 SMES for compensation of voltage fluctuations cooled by the liquid hydrogen would be effective by synergy effect. However, the MgB2 introduction to large–scale devices is still not enough and under		

整理番号	2351	イタリア	
分類1	1	1	1
著者	Antonio Morandi , Alessandro Anemona, Giuliano Angeli , Marco Breschi , Antonio Della Corte ,Carlo Ferdeghini , Chiara Gandolfi, Gabriele Grandi ,Gianni Grasso, Luciano Martini, Umberto Melaccio, Davide Nardelli, Pier Luigi Ribani , Sergio Siri, Matteo Tropeano, Simonetta Turt`u, and Maurizio Vignolo		
タイトル	The DRYSMES4GRID Project: Development of a 500 kJ/200 kW Cryogen–Free Cooled SMES Demonstrator Based on MgB2		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 3,		
発行年	2018	PAGE. 5700205	
概要	A three–year research project, called DRYSMES 4GRID, was recently funded by the Italian Minister of EconomicDevelopment, Italy. The project, which involves five Italian partners (companies, universities, and research institutes), is aimed to demonstrate the feasibility of cost–competitive SMES based on magnesium diboride (MgB2) with a cryogen–free cooling bymeans of the manufacturing and the testing of a demonstrator with an objective rating of 500 kJ/200 kW. This rating is deemed suitable for disclosing the critical technological aspects of all components in view of practical applications. A further goal of the project is the assessment of the technical and economic benefits that the SMES can bring to		

整理番号	2352	中国	
分類1	1	1	11
著者	Wenyong Guo , Member, IEEE, Guomin Zhang , Jingye Zhang, Naihao Song, Zhiyuan Gao, Xi Xu, Liwei Jing, Yuping Teng, Zhiqin Zhu, and Liye Xiao		
タイトル	Development of a 1-MVA/1-MJ Superconducting Fault Current Limiter-Magnetic Energy Storage System for LVRT Capability Enhancement and Wind Power Smoothing		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4,		
発行年	2018	PAGE. 5700505	
概要	A 1-MVA/1-MJ superconducting fault current limiter-magnetic energy storage system (SFCL-MES) has been developed. The SFCL-MES utilizes one superconducting coil to both enhance the low-voltage ride-through capability of wind turbine and smooth wind power output. The developed SFCL-MES was installed and put into operation in a wind farm northwest of China. This paper presents final design and test of the four major components of SFCL-MES: power conditioning system, cryogenic system, supercon ducting coil, and monitoring system. Test results of the SFCL-MES are also presented. Test		

整理番号	2353	中国	
分類1	1	1	11
著者	Xian-Yong Xiao , Ruo-Huan Yang , Xiao-Yuan Chen , and Zi-Xuan Zheng		
タイトル	Integrated DFIG Protection With a Modified SMES-FCL Under Symmetrical and Asymmetrical Faults		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4,		
発行年	2018	PAGE. 5400606	
概要	Scarce fault ride through capacity and unsteady output power are two vital problems in various in-grid doubly fed induction generators (DFIGs). This paper investigates an integrated DFIG protection scheme with a modified superconducting magnetic energy storage-fault current limiter (SMES-FCL). Based on proper parameter estimation of superconducting coil (SC) inside the SMES-FCL, modified controls of the SC and rotor side converter (RSC) are presented. Simulation results obtained from a 1.5 MW DFIG-based wind turbine case show that the proposed scheme is capable of limiting the peak values of fault rotor current, DC-link voltage and electromagnetic (EM) torque under symmetrical and asymmetrical		

整理番号	2354	中国	
分類1	1	1	11
著者	Y. Xu , Y. Li , L. Ren , C. Xu, Y. Tang, J. Li, L. Chen , and B. Jia		
タイトル	Research on the Application of Superconducting Magnetic Energy Storage in Microgrids for Smoothing Power Fluctuation Caused by Operation Mode Switching		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4,		
発行年	2018	PAGE. 5701306	
概要	It is widely known that the power supply would be interrupted during mode switching between grid-connected and islanded operation in a microgrid, which might lead to voltage and frequency fluctuations of the microgrid. As a power-type energy storage device, superconducting magnetic energy storage (SMES) is capable of providing rapid power response for either charge or discharge within a few milliseconds. In order to study the feasibility of applying SMES to microgrid, a microgrid model with SMES was built with Matlab/Simulink platform, and the compensation performance of SMES on the power fluctuation ofmicrogrid was simulated and analyzed. The compensation power and current of the		

整理番号	2355	中国	
分類1	1	1	1
著者	Jian-Xun Jin , Xiao-Yuan Chen , Xiao-Dong Liu, Zheng-Hua Chen, and Jie-Gang Peng		
タイトル	Influence of Flux Diverter on Energy Storage Property of Small SMES Magnet Wound by 100-m-Class GdBCO Tape		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4,		
発行年	2018	PAGE. 5700905	
概要	Solenoid-type superconducting magnetic energy storage (SMES) magnets have strong anisotropic field dependence. To enhance the minimum critical current located at two end, a novel flux diverter with a raised edge is investigated in this paper. Five small solenoid magnets having different axial layers and a fixed tape usage are used to evaluate and compare the effects of the raised-edge diverters on self-inductance, minimum critical current, and maximum energy storage capacity. An energy storage parameter KE (J/m) obtained by dividing the maximum energy storage capacity by the tape usage, and an available energy parameter Euse (J) at a fixed rated output current are introduced to evaluate the		

整理番号	2356	中国	
分類1	1	1	11
著者	Zixuan Zheng , Xianyong Xiao , Xiao Yuan Chen , Chunjun Huang, and Jiao Xu		
タイトル	Performance Evaluation of a MW-Class SMES-Based DVR System for Enhancing Transient Voltage Quality by Using d-q Transform Control		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4,		
発行年	2018	PAGE. 5700805	
概要	A conceptual design and performance evaluation of a megawatt (MW) class dynamic voltage restorer system are presented for mitigation of voltage-quality disturbances. To detect possible voltage disturbances quickly and, thus, to compensate the transient voltage waveform immediately after the occurrences of voltage disturbances, a new instantaneous d-q transform detection method is introduced. Subsequently, a pre-sag compensation strategy is introduced to lock the instantaneous magnitudes and phase angles of real-time line voltages for compensating the improper voltage components completely. A 0.3-H/1.76-kA superconducting magnetic energy storage (SMES) magnet is		

整理番号	2357	中国	
分類1	1	1	10
著者	Ruturaj Soman , Harsha Ravindra, Xiaohua Huang, Karl Schoder , Michael Steurer, Weijia Yuan, Min Zhang, Sriharsha Venuturumilli, and Xi Chen		
タイトル	Preliminary Investigation on Economic Aspects of Superconducting Magnetic Energy Storage (SMES) Systems and High-Temperature Superconducting (HTS) Transformers		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4,		
発行年	2018	PAGE. 5400805	
概要	This research investigates the economic aspects of using superconducting magneti energy storage (SMES) systems and high-temperature superconducting (HTS) transformers as reported by utilities and other projects. The focus is on producing a preliminary set of information that could form a guideline in estimating cost-benefit-related numbers for these technologies. In this paper, a literature review of studies using SMES systems and HTS transformers is presented and an effort is made to highlight major cost factors and drivers based on available information. In conclusion, it is evident that more utility scale studies need to be undertaken to have a comprehensive understanding of the economic benefits of		

整理番号	2358	フランス	
分類1	1	1	1
著者	Jeremie Ciceron , Arnaud Badel , Pascal Tixador, Rapha¨el Pasquet, and Frederick Forest		
タイトル	Test in Strong Background Field of a Modular Element of a REBCO 1 MJ High Energy Density SMES		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4		
発行年	2018	PAGE. 5701005	
概要	A superconducting magnetic energy storage (SMES) is a promising technology for pulse power current source. Nevertheless, they have modest specific energy. Taking advantage of new possibilities offered by the impressive performances of second generation high-temperature superconductors (HTS) tapes in liquid helium, the BOSSE project has the objective to build an SMES with a specific energy of 20 kJ/kg in the MegaJoule range (present world record is 13 kJ/kg). To reach such a high specific energy, high levels of stress and current density are equired. A full-size prototype pancake, made of a 139-m-long insulated HTS conductor, has been tested in background magnetic field up to 8 T in Grenoble LNCMI.		

整理番号	2359	中国	
分類1	1	1	10
著者	Xiao Zhou , Yuejin Tang, Shi Jing, Chi Zhang , Kang Gong, Lihui Zhang, and Yuanyuan Li		
タイトル	Cost Estimation Models of MJ Class HTS Superconducting Magnetic Energy Storage Magnets		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4		
発行年	2018	PAGE. 5701105	
概要	**An HTS superconducting magnetic energy storage (SMES) can be utilized to improve the security and stability of the power grid with renewable energy generation. In different application scenarios, the requirements for capacity and power of the SMES varies, which needs the appropriate SMES allocation in the power grid. A cost estimation is the key component for the SMES allocation.Therefore, this paper proposed a cost estimationmethod of an HTS SMES, which synthetically considers the design, manufacture, operation, maintenance, and application scenarios. First, the cost estimationmodel of an HTS SMES**		

整理番号	2360	中国	
分類1	1	1	1
著者	Peng Song , Jiahui Zhu , Timing Qu , Panpan Chen, Feng Feng , and Ming Qiu		
タイトル	Design and Test of a Double Pancake Coil for SMES Application Wound by HTS Roebel Cable		
出典	IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 28, NO. 4		
発行年	2018	PAGE. 5701205	
概要	A double pancake coil wound by HTS Roebel cable was designed, fabricated, and tested at 77 K. This coil winding had eight turns with the inner diameter of 340 mm and a total conductor length of 10 m.With ten ReBCO strands, the transposition length of the cable was 300 mm. To avoid delamination of ReBCO strands, this coil was impregnated with paraffin wax by a vacuum impregnation method. For protecting ReBCO strands, protective copper plates (PCP) were inserted and soldered between cable surface and external current terminal. The oltage probes were not directly soldered on strands, but on the PCP instead. The critical current		

整理番号	2361	中国	
分類1	1	1	5
著者	Xiao Yuan Chen*, Juan Feng, Mian Gang Tang, Qiang Xu, Guo Hui Li		
タイトル	Superconducting Magnetic Energy Exchange Modelling and Simulations under Power Swell/Sag Conditions		
出典	Energy Procedia 105		
発行年	2017	PAGE. 4116 – 4121	
概要	This paper presents a simplified superconducting magnetic energy exchange (SMEE) model for the potential use in the parameter design and performance evaluation of superconducting magnetic energy storage (SMES) devices prior to their practical developments and applications in modern power system. In this model, the targeted power system applications are transformed into equivalent energy exchange demands for the SMES coils in a simplified DC power network without conventional DC–AC power devices. Both the steady–power and dynamic–power energy exchange simulations are carried out to clarify the feasibility of the proposed SMEE model for the design, optimization and evaluation of a		

整理番号	2362	中国	
分類1	1	1	1
著者	Ming Qiua, Shuangquan Raoa, Jiahui Zhua, Shanshan Fua, Zhenming Lia, Wei Liua, Panpan Chena, Jun Gongb		
タイトル	Energy Storage Characteristics of MJ–Class Toroidal HTSSMES Considering Maximum Value of Perpendicular		
出典	Energy Procedia 105		
発行年	2017	PAGE. 4179 – 4184	
概要	The Superconducting Magnet Energy Storage (SMES) will be more and more popular in the electric power system in the near future. A toroidal SMES magnet with large capacity is a tendency for SMES because it has great energy density and low stray field. Firstly, a toroidal HTS–SMES magnet model is built to obtain the maximum value of the perpendicular magnetic field by the finite element method (FEM), and then the storage energy is calculated. Secondly, the operating current Iop=1kA and internal radius Ri=150mm keep unchangeable to research the relationship for the storage energy E, the number of double pancake coil (DPC) n wound by 150m YBCO tapes and the distance from the element coil		

整理番号	2363	英国	
分類1	1	1	9
著者	Qixing Sun*, Dong Xing, Qingqing Yang, Huiming Zhang, Jay Patel		
タイトル	A New Design of Fuzzy Logic Control for SMES and Battery Hybrid Storage System		
出典	Energy Procedia 105		
発行年	2017	PAGE. 4575 – 4580	
概要	In this paper, the superconducting magnetic energy storage (SMES) and battery hybrid energy storage system has been designed to deal with high fluctuating power demand due to their complementary advantage. A lot of researchers are focusing on using battery technology to deal with low frequency demand and using SMES to deal with the remaining power demand. In this paper, a new energy management control method using 3 input parameters to a fuzzy logic controller is firstly proposed to deal with high fluctuating power demands. An example data rocessing result is shown in this paper. The results show that the hybrid		

整理番号	2364	インド	
分類1	1	1	9
著者	CH. Durga Prasad, G. Pavan Kumar, D.J.V. Prasad, N. Sriniasu., Dr. M.Sai Veerraju		
タイトル	Combined Tuning of Secondary Controller along with Energy Storage Devices in a Multi Area Interconnected Power System		
出典	Energy Procedia 117		
発行年	2017	PAGE. 878-884	
概要	Simultaneous tuning of conventional secondary controller along with different energy storage devices is presented in this paper. For each generating unit of an interconnected power system, in addition to primary control, a secondary controller is placed to reduce the frequency oscillations and to control power flow between the areas which are interconnected together. In this paper, along with the secondary controllers, energy storage devices are placed for better control of system frequency and tie line powers. Particle swarm optimization algorithm is chosen for obtaining proper control parameters for both units. Later, the effect of these additional components is compared with the conventional two area		

整理番号	2365	中国	
分類1	1	1	1
著者	ing Xu, Li Ren, Zhongping Zhang, Yuejin Tang, Jing Shi, Chen Xu, Jingdong Li, Dongsheng Pu, Zhuang Wang, Huajun Liu, Lei Chen		
タイトル	Analysis of the loss and thermal characteristics of a SMES (Superconducting Magnetic Energy Storage) magnet with three practical operating conditions		
出典	Energy, vol. 143		
発行年	2018	PAGE. 372-384	
概要	The losses of Superconducting Magnetic Energy Storage (SMES) magnet are not neglectable during the power exchange process with the grid. In order to prevent the thermal runaway of a SMES magnet, quantitative analysis of its thermal status is inevitable. In this paper, the loss characteristics of a self-developed 150 kJ SMES magnet are analyzed by means of experiments and simulations, including the loss of the joint resistance, the eddy current loss of the metal cooling structures and the AC loss of the superconducting magnet. A thermal model of the magnet was built to theoretically analyze the relationship between the current and magnet temperature variation. Three kinds of power compensation		

整理番号	2366	英国	
分類1	1	1	11
著者	A. G. Olabi		
タイトル	Renewable energy and energy storage systems		
出典	Energy, vol. 136		
発行年	2018	PAGE. 1-6	
概要	With the increase of the production of power/energy from renewables it becomes much important to look at methods and techniques to store this energy. In principle, the renewable energy can be transformed into another form of storable energy and to be transformed back when needed. The main Energy storage techniques can be classified as: 1) Magnetic systems: Superconducting Magnetic Energy Storage, 2) Electrochemical systems: Batteries, fuel cells, Super-capacitors, 3) Hydro Systems: Water pumps, 4) Pneumatic systems: Air compressors, 5) Mechanical systems: Flywheels, 6) Thermal systems: Molten Salt, Water or oil heaters. When we are talking about energy storage systems, we should consider		

整理番号	2367	スペイン	
分類1	1	1	11
著者	Antonio Colmenar-Santos, Enrique Luis-Molina, Enrique Rosales-Asensio, África Lopez-Re		
タイトル	Technical approach for the inclusion of superconducting magnetic energy storage in a smart city		
出典	Energy, in press		
発行年	2018	PAGE.	
概要	Smart grids are a concept which is evolving quickly with the implementation of renewable energies and concepts such as Distributed Generation (DG) and micro-grids. Energy storage systems play a very important role in smart grids. The characteristics of smart cities enhance the use of high power density storage systems, such as SMES systems. Because of this, we studied the possibility of adapting these systems in this kind of electrical topology by simulating the effects of an energy storage system with high power density (as SMES). An electrical and control adaptation circuit for storing energy was designed. The circuit consisted of three blocks. The first one was a passive filter LCL. The second was a		

整理番号	2368	エジプト	
分類1	1	1	9
著者	M. Elsisi, M. Soliman, M. A. S. Aboelela, W. Mansour		
タイトル	Optimal design of model predictive control with superconducting magnetic energy storage for load frequency control of nonlinear hydrothermal power system using bat inspired algorithm		
出典	Journal of Energy Storage, vol. 12		
発行年	2017	PAGE. 311-318	
概要	This paper proposes bat inspired algorithm (BIA) as a new optimization approach of a model predictive control (MPC) and superconducting magnetic energy storage (SMES) for load frequency control (LFC) of a two-area interconnected hydrothermal system. The proposed power system model includes generation rate constraint (GRC), governor dead band, and time delay. Conventionally, the parameters of MPC controller and SMES are obtained by trial and error method or experiences of designers. To overcome this problem, the BIA is applied to simultaneously tune the parameters of MPC controller and SMES to minimize deviations of frequency and tie-line power flow of the interconnected power system against		

整理番号	2369	インド	
分類1	1	1	11
著者	Raja Sekhar Dondapati, Abhinav Kumar, Gadekula Rajesh Kumar, Preeti Rao Usurumarti, Sreekanth Dondapat		
タイトル	Superconducting magnetic energy storage (SMES) devices integrated with resistive type superconducting fault current limiter (SFCL) for fast recovery time		
出典	Journal of Energy Storage, vol. 13		
発行年	2017	PAGE. 287-295	
概要	Energy storage devices experience load fluctuations due to fault currents, lightening and non-uniform load distribution. Hence, Superconducting Magnetic Energy Storage (SMES) devices are incorporated to balance these fluctuations as well as to store the energy with larger current density. Further, Superconducting Fault Current Limiter (SFCL) are integrated with SMES for avoiding fault currents. In addition, SFCL are preferred in electrical utility networks due to their better technical performance during faults as compared to the conventional Circuit Breakers. Self-triggering from superconducting state to normal state during fault and very fast recovery to its original superconducting state after fault		

整理番号	2370	インド	
分類1	1	1	9
著者	M. Nandi, C. K. Shiva, V. Mukherjee		
タイトル	Frequency stabilization of multi-area multi-source interconnected power system using TCSC and SMES mechanism		
出典	Journal of Energy Storage, vol. 14		
発行年	2018	PAGE. 348-362	
概要	The present aspect studies automatic generation control (AGC) of a multi-area multi-source test system with the effects of thyristor controlled series compensation (TCSC) and superconducting magnetic energy storage (SMES) units. The studied test system is a three-area power system model having thermal-thermal unit in area-1, thermal-hydro unit in area-2 and thermal-gas unit in area-3. The same is imposed by appropriate time delay, governor deadband, generation rate constraint nonlinearities. A nature-inspired optimization technique called moth-flame optimization algorithm is implemented for solving the constrained optimization parameters. The step load perturbation (SLP) and random SLP are		

整理番号	2371	コロンビア	
分類1	1	1	9
著者	Oscar Danilo Montoya, Alejandro Garcés, Gerardo Espinosa-Pérez		
タイトル	A generalized passivity-based control approach for power compensation in distribution systems using electrical energy storage systems		
出典	Journal of Energy Storage, vol. 16		
発行年	2018	PAGE. 259-268	
概要	This paper presents a generalized interconnection and damping assignment passivity-based control (IDA-PBC) for electric energy storage systems (EESS) such as: superconducting magnetic energy storage (SMES) and supercapacitor energy storage (SCES). A general framework is proposed to represent the dynamical behavior of EESS interconnected to the electrical distribution system through forced commutated power electronic converters. A voltage source converter (VSC) and a pulse-width modulated current source converter (PWM-CSC) are used to integrate SCES and SMES systems to the electrical power systems respectively. The proposed control strategy allows active and reactive power		

整理番号	2372	コロンビア	
分類1	1	1	9
著者	Oscar Danilo Montoya, Walter Gil-González, Alejandro Garcés, Gerardo Espinosa-Pérez		
タイトル	Indirect IDA-PBC for active and reactive power support in distribution networks using SMES systems with PWM-CSC		
出典	Journal of Energy Storage, vol. 17		
発行年	2018	PAGE. 261-271	
概要	n this paper an indirect interconnection and damping assignment passivity-based control (IDA-PBC) applied to the three-phase superconducting magnetic energy storage systems (SMES) is proposed to support active and reactive power in distribution systems. The SMES is connected to the distribution network using a pulse-width-modulated current source converter (PWM-CSC), due to its intrinsic current features that are more natural for controlling the current of a superconducting coil. A Hamiltonian function is selected as an hyperboloid representation taking into account the open loop dynamics of the system. The indirect control strategy is used to decouple the dynamical behavior		

整理番号	2373	日本	
分類1	1	1	1
著者	桑原優介・水落 空・神保茉那・上林昌弘・高尾智明・谷貝 剛（上智大学）・新冨孝和・槇田康博（高エネルギー加速器研究機構）・濱島高太郎・駒込敏弘（前川製作所）		
タイトル	熱処理前に施す凹みがMgB2素線の臨界電流に及ぼす影響		
出典	平成30年電気学会前項区大会概要集		
発行年	2018	PAGE. 5-172	
概要	MgB2の応用例のひとつであるSMESコイルはMW級の入出力を行うため，それを用いた素線は撚り線加工による多芯化が必要である。本研究では，ラザフォードケーブル作製時の撚線加工における撚りピッチ(58，69，82mm)に対応するような素線間交差角度(22，18，14度)でMgB2素線を互いに交差させ，上部から荷重を印加する装置を作製し、MgB2素線のIC劣化率を調査した。その結果，加えた荷重が大きくなると臨界電流の劣化も大きくなった。また，規格化臨界電流で95%が劣化の基準だと考えると，撚りピッチ58 mmのラザフォードケーブルを作製する際に与えても問題ないとされる荷重と凹み量は，それぞれ600 N，0.25 mm以下であると考えられる。		

整理番号	2374	日本	
分類1	1	1	1
著者	駒込敏弘・塚田謙一・濱島高太郎（前川製作所）・新冨孝和・槇田康博（高エネルギー加速器研究機構）・谷貝 剛・高尾智明（上智大学）・平野直樹（中部電力）・富田 優・恩地太紀（鉄道総合技術研究所）		
タイトル	超電導磁気エネルギー貯蔵装置用MgB2コイルの製作および励磁試験結果		
出典	平成30年電気学会前項区大会概要集		
発行年	2018	PAGE. 5-155	
概要	液体水素温度域で利用可能で、将来の価格低減が期待される、MgB2導体を使用した超電導磁気エネルギー貯蔵装置SMESシステム技術の開発を目指している。主要な開発課題は、MgB2素線の大電流導体化、コイル化および液体水素による冷却技術の開発である。大電流導体化、コイル化の際は、製作の各工程において、素線歪みが許容値を上回らないよう慎重に、加工条件を決定する必要がある。今回、複数の素線を撚り合わせて大電流導体を製作し、導体で巻線したコイルの励磁試験に世界で初めて成功したので、報告する。		

整理番号	2375	日本	
分類1	1	1	1
著者	谷貝 剛， 水野伸哉，大久保 徹，安藤憲之介，水落 空，高尾智明（上智大学），平野直樹（中部電力） 槇田康博 新冨孝和（KEK）駒込敏弘 塚田謙一（前川製作所），恩地太紀 荒井 有気 富田 優（鉄道総研） 濱島高太郎（前川製作所）		
タイトル	MgB2 線材を用いたR&W 方式大容量導体とSMES コイルの設計		
出典	電気学会応用超伝導研究会		
発行年	2018	PAGE. ASC－17－001	
概要	MgB2 wire becomes more attractive for large scale applications like superconducting magnetic energy storage (SMES) due to developing superconducting characteristic and reducing it cost. For large scale applications, the MgB2 must be used by forming conductors assembled and twisted conductor to aim at getting large current capacity. Through the coil winding process with pancake winding technique, we are planning to make around 33 kJ stored energy magnet system for an energy storage device. In terms of coil and		

整理番号 2376 日本

分類1 1 1 1

著者 槇田康博, 新冨孝和, 濱島高太郎, 駒込敏弘, 塚田謙一, 平野直樹, 長屋重夫, 渡部智則, 高尾智明, 谷貝剛, 水落空, 水野伸哉, 神保茉那, 上林昌弘, 恩地太紀, 富田優

タイトル MgB2ラザフォードケーブルによるダブルパンケーキコイル試作

出典 第95回 2017年度秋季低温工学・超電導学会予稿集

発行年 2017 PAGE. 2P-p04

概要 水素エネルギーしsつてむに, 液体水素で冷却されるSMESを連携させ電力制御を高度化することを提案している。コイルの超伝導線材としては, 撚線化に向く素線形状のMgB2に着目している。ただし, Nb3Sn線同様, MgB2線も歪みによる超伝導特性の劣化は確認されており, 撚線加工やコイル巻線時の劣化の特性を理解しておかなければならない, 加工方法の最適化を目指して, 素線を調達して撚り線し, Wind & React法及びReact & Wind法によるパンケーキコイルを1個ずつ試作し, ェkちあへ利う夢中で予備冷却試験を行った。

整理番号 2377 日本

分類1 1 1 1

著者 恩地太紀, 石原篤, 小林祐介, 赤塚友幸, 荒井有気, 福本祐介, 富田優, 水野伸哉, 谷貝剛, 平野直樹, 槇田康博, 新冨孝和, 濱島高太郎

タイトル MgB2ケーブルを用いたダブルパンケーキコイルの開発(2)

出典 第95回 2017年度秋季低温工学・超電導学会予稿集

発行年 2017 PAGE. 2P-p05

概要 MgB2は, 金属系超電導体最高の約40KのTcをもち, 各種コイルへの応用が検討されている。我々のグループでは, 伝導冷却による数10kJ級の超電導電力貯蔵システム(SMES)の開発を目指し, MgB2線材を用いたパンケーキコイルの設計, 製作を行っている。これまで我々のグループでは, Hyper Tech社の熱処理前のMgB2超電送素線をもちい, 撚線加工により導体製作, Wind & React (W&R)方式でのパンケーキコイル緒製作, ならびに動作試験を行ってkちあ。本研究では, コイルのレイン臨界電流値の温度・磁場依存性(Ic-B-T)の評価を行ったので報告する。

整理番号 2378 日本

分類1 1 1 1

著者 上林昌弘, 水落空, 神保茉那, 桑原優介, 高尾智明, 谷貝剛, 新冨孝和, 槇田康博, 濱島高太郎, 駒込敏弘, 塚田謙一, 平野直樹, 富田優, 恩地太紀

タイトル 熱処理前の曲げ歪みがMgB2素線の臨界電流に及ぼす影響

出典 第95回 2017年度秋季低温工学・超電導学会予稿集

発行年 2017 PAGE. 3C-a02

概要 MgB2線は, 臨界温度が39Kであり, 安価で資源が豊富であることから, エネルギー貯蔵装置用のコイルなど将来の実用化が期待されている。また, 超電導応用機器に利用するためには, 撚り線製作による大容量化も必要となる。しかし, コイルや撚り線製作の際, 曲げ歪よる素線の劣化が懸念される。そこで, フィラメントにかかる熱処理前の歪み率を変えたサンプルを製作し, 臨界電流の変化を測定することで, 臨界電流-歪み率特性の調査を行った。

平成 29 年度 SMES 関連論文情報

編　集　技術委員会
発行日　平成 30 年 7 月
発　行　超電導エネルギー貯蔵研究会
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