

# **2021 Brazilian Power Electronics Conference (COBEP 2021)**

**Joao Pessoa, Brazil  
7 – 10 November 2021**



**IEEE Catalog Number: CFP2177F-POD  
ISBN: 978-1-6654-2130-0**

**Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP2177F-POD
ISBN (Print-On-Demand):	978-1-6654-2130-0
ISBN (Online):	978-1-6654-2129-4
ISSN:	2165-0454

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# TABLE OF CONTENTS

CONTROL STRATEGY BASED ON FREQUENCY RESPONSE FOR A SINGLE-PHASE FULL-BRIDGE SERIES ACTIVE FILTER..... <i>Tiago Davi Curi Busarello</i>	1
SINGLE-PHASE CURRENT SOURCE RECTIFIER WITH POWER DECOUPLING USING THE X-TYPE CSC TOPOLOGY ..... <i>Montiê Alves Vitorino, Lucas Vinícius De Araújo Gomes</i>	8
MITIGATION OF TORQUE OSCILLATIONS CAUSED BY DC INJECTION-BASED RESISTANCE ESTIMATION THROUGH RESONANT CONTROLLERS..... <i>Diogo Borges Da Silveira, João Victor Matos Farias, Heverton Augusto Pereira, Alex-Sander Amável Luiz, Marcelo Martins Stopa, Allan Fragner Cupertino</i>	14
A SMOOTH PRE-CHARGING STRATEGY FOR AN OFFSHORE HVDC SYSTEM BASED ON MODULAR MULTILEVEL CONVERTERS..... <i>Matheus S. Paulo, Samuel N. Duarte, Frederico T. Ghetti, Pedro M. Almeida, Pedro G. Barbosa</i>	20
EFFECT OF PLL ON CURRENT DISTORTION OF DROOP-CONTROLLED CONVERTERS IN A CONTROL-IN-THE-LOOP SIMULATION OF A MICROGRID ..... <i>Eliabe Duarte Queiroz, João Inácio Yutaka Ota, José Antenor Pomilio</i>	28
VIRTUAL LEARNING PROCESS IN THE DEGREE OF RENEWABLE ENERGIES AT UNIVERSITY OF CHUBUT WITH TYPHOON HIL CONTROL CENTER..... <i>T. Hernandez</i>	36
ROBUST SWITCHING RULE DESIGN FOR SINGLE-PHASE SHUNT ACTIVE POWER FILTER ..... <i>Vitor Leobet Lima, Tiago Jackson May Dezuó</i>	40
DIRECT INSTANTANEOUS TORQUE CONTROL OF SWITCHED RELUCTANCE MACHINES FOR LOW TORQUE RIPPLE REGENERATIVE BRAKING..... <i>Marcelo Vinícius De Paula, Elmer Osman Hancco Catata, Ernesto Ruppert Filho, Tarcio André Dos Santos Barros, Sheldon Williamson</i>	44
HYBRID ENERGY STORAGE SYSTEM SIZING FOR SMOOTHING RENEWABLE GENERATION INTERMITTENCIES ..... <i>Guilherme Masquetti Pelz, Sérgio Augusto Oliveira Da Silva, Leonardo Poltronieri Sampaio</i>	49
STACKED BIDIRECTIONAL BOOST DC-DC CONVERTER..... <i>Fabiano Gonzales Nimitti, António Manuel Santos Spencer Andrade, Julian Cezar Giacomini</i>	54
SYNCHRONOUS DISTURBANCE SUPPRESSION IN BEARINGLESS MACHINES WITH ACTIVE DISTURBANCE REJECTION CONTROLLER ..... <i>Irlete P. Mota Alves, Werbet L. A. Silva, Francisco E. C. Souza, Andres O. Salazar</i>	62
SINGLE SWITCH HIGH STEP-UP SOFT-SWITCHING BOOST CONVERTER WITH COUPLED INDUCTOR..... <i>Jelais Jean Francois, Antonio M. S. S. Andrade, Fábio Ecke Bisogno</i>	67

UNDERWATER WIRELESS POWER TRANSFER WITH HIGH TOLERANCE TO MISALIGNMENTS .....	75
<i>Israel Filipe Lopes, Daiana Carmo Coelho, Esteban Vicente Aguilar Bojorge, Luiz Rogério Andrade De Oliveira, Andrei De Oliveira Almeida, Pedro Gomes Barbosa</i>	
NEUTRAL CURRENT'S EFFECT ON FOUR-WIRE VOLTAGE SOURCE CONVERTER CONTROL SYSTEMS .....	80
<i>Paulo F. Silva, Claudionor F. Nascimento, Amilcar F. Q. Gonçalves, Alex F. Silva, Alfeu J. Sguarezi Filho, Oumar Diene</i>	
CONTROLS OF A DISPATCHABLE POWER SOURCE AND A GRID TIE CONVERTER FOR BATTERY BANK CHARGING IN ISOLATED MICROGRID .....	86
<i>Alyston Claydson V. Nascimento, Hércules Araújo Oliveira, José Gomes De Matos, Luiz Antonio De Souza Ribeiro, Lucas De Paula Assunção Pinheiro</i>	
BUCK-BOOST-FORWARD AC/DC CONVERTER DESIGN SUPPORTED BY COMPUTER-AIDED ENGINEERING.....	94
<i>Marcelo Weber Contri, Bruno Facco Almeida, Vitor Cristiano Bender</i>	
ONE CYCLE CONTROL APPLIED TO A THREE-PHASE PWM RECTIFIER .....	101
<i>Rodrigo De Andrade Teixeira, Andres Ortiz Salazar, Elmer Rolando Llanos Villarreal, Werbet Luiz Almeida Da Silva, João Teixeira De Carvalho Neto</i>	
IMPACT OF BIFACIAL MODULES ON THE INVERTER CLIPPING IN DISTRIBUTED GENERATION PHOTOVOLTAIC SYSTEMS IN BRAZIL .....	107
<i>João Lucas De Souza Silva, Karen Barbosa De Melo, Tatiane Silva Costa, Gilson Mario Vieira Machado, Hugo Soeiro Moreira, Marcelo Gradella Villalva</i>	
STUDY OF HIGH STEP-UP NON-ISOLATED DC-DC CONVERTERS .....	113
<i>Aluísio Alves De Melo Bento, Christian Mothe De Castro, Lucas Cheida Galvão Sanches Garcia</i>	
SIMULATION OF THE DC-AC CONVERTER CONTROL FOR AN ISOLATED PV SYSTEM.....	120
<i>Maria Paula Mantilla Arias, Diego Andrés Bautista López, Laura Camila Plazas Hernández, Esteban Ricardo Prieto Galindo, Edwar Javier Patiño Núñez, Edgar Leonardo Castellanos Solano, Juan Carlos Saavedra Merchán</i>	
CAPACITIVE VIRTUAL IMPEDANCE ACTIVE DAMPING DESIGN FOR IMPROVED HARMONIC REJECTION IN SINGLE-PHASE GRID-TIED CONVERTERS.....	124
<i>Arthur De A. Romão, Newton Da Silva</i>	
MODELING AND CONTROLLERS DESIGN FOR AN ELECTROMAGNETIC FREQUENCY REGULATOR APPLIED TO WIND SYSTEMS.....	130
<i>Thiago F. Do Nascimento, Evandro A. F. Nunes, Andres O. Salazar</i>	
OPTIMIZED SIMULTANEOUS TUNING OF VSI CONTROLLERS IN AUTONOMOUS MICROGRIDS USING DIFFERENTIAL EVOLUTION METAHEURISTIC .....	138
<i>Bruno Leandro Galvão Costa, Sérgio Augusto Oliveira Da Silva</i>	
COMPARATIVE ANALYSIS OF PSO TECHNIQUES APPLIED IN A SINGLE-PHASE GRID-TIED PV SYSTEM .....	146
<i>Guilherme De L. Lopes, Leonardo P. Sampaio, Sergio A. O. Da Silva</i>	
ANALYSIS AND COMPARISON OF SPS, EPS AND DPS MODULATION SCHEMES FOR DUAL ACTIVE BRIDGE CONVERTER.....	153
<i>Romário De Souza Coelho, Alessandro Luiz Batschauer</i>	

INSIDE RESIDENTIAL DISTRIBUTED GENERATION: A LOOK OF HIGH FREQUENCY CONTAMINATION .....	156
<i>Gustavo Orteni, José Antenor Pomilio</i>	
AN AC-DC CONVERTER WITH PFC AND SIMILAR EFFICIENCY IN 110 V/220 V AC INPUT VOLTAGES .....	162
<i>V. V. Do Rêgo, D. De A. Honório, R. P. Torrico Bascope, G. V. Torrico Bascope</i>	
OUTPUT-VOLTAGE-RIPPLE INJECTION FOR REDUCTION OF INPUT-CURRENT THD IN SINGLE-PHASE DCM BOOST RECTIFIER.....	168
<i>Valdecir Junior De Paris, Guilherme Bauer, Telles Brunelli Lazzarin, Moises Carlos Tanca-Villanueva</i>	
DIFFERENTIAL POWER PROCESSING APPLIED TO A PHOTOVOLTAIC STRING WITH DIFFERENT MODULES .....	176
<i>Caio Meira Amaral Da Luz, Enio Roberto Ribeiro, Fernando Lessa Tofoli</i>	
DESIGN OF DAMPING STRATEGIES FOR LC FILTER IN MEDIUM VOLTAGE INDUCTION MOTOR DRIVES .....	182
<i>Diury Gonçalves, João Victor Matos Farias, Heverton Augusto Pereira, Alex-Sander Amável Luiz, Marcelo Martins Stopa, Allan Fagner Cupertino</i>	
POWER MANAGEMENT STRATEGY FOR A MODIFIED INTERLINKING CONVERTER IN A STANDALONE HYBRID AC/DC MICROGRID .....	189
<i>João Pedro Carvalho Silveira, Pedro José Dos Santos Neto, Tarcio André Dos Santos Barros, Ernesto Ruppert Filho</i>	
GENERAL EVALUATION OF RECTIFIER ARRANGEMENTS FOR THE THREE-PHASE DC/DC CONVERTER.....	196
<i>Davi Araujo Chaves Souza, Paulo Peixoto Praça, Luiz Henrique Silva Colado Barreto, Samanta Gadelha Barbosa, Fernando Lessa Tofoli, Demercil De Souza Oliveira</i>	
SIAMESE NEURAL NETWORK ARCHITECTURE FOR FAULT DETECTION IN A VOLTAGE SOURCE INVERTER.....	202
<i>Lincoln Moura De Oliveira, Francisco Eduardo Mendes Da Silva, Gabriel Marçal Da Cunha Pereira, Demercil Souza Oliveira, Fernando Luiz Marcelo Antunes</i>	
IMPROVING TRANSIENT RESPONSE OF A SYNCHRONOUS GENERATOR EMULATION TECHNIQUE APPLIED TO GRID-TIED CONVERTERS .....	206
<i>Thiago F. Do Nascimento, Andres O. Salazar</i>	
MODELING AND CONTROLLERS DESIGN FOR THREE-LEG AND FOUR-LEG GRID- FORMING CONVERTERS: A BENCHMARK .....	213
<i>Jéssica S. Döhler, Dalmo C. Silva Júnior, Janaína G. De Oliveira, André Augusto Ferreira</i>	
FAMILY OF BIDIRECTIONAL BOOST/BUCK DC-DC CONVERTER.....	221
<i>Fabiano Gonzales Nimitti, Mauricio Mendes Da Silva, António Manuel Santos Spencer Andrade</i>	
AN FPGA-BASED HARDWARE-IN-THE-LOOP IMPLEMENTATION OF POWER ELECTRONICS CIRCUITS USING A GENERIC REAL-TIME SIMULATOR .....	227
<i>Matheus Sotero, Gonçalo Fontenele, Felipe Dicler, Marcello Neves, Luiz Felipe Corrêa, Mauricio Aredes</i>	
POWER QUALITY IMPROVEMENTS IN AIRCRAFT SYSTEMS: A PROPOSAL USING A 24-PULSE CONVERTER FOR HARMONIC MITIGATION .....	235
<i>Hugo Oliveira Vilas Boas, Angelo José Junqueira Rezek, Christel Enock Ghislain Ogoulola</i>	

CONTROL STRATEGIES FOR MULTIFUNCTIONAL ACTIVE FRONT-END CONVERTER IN OIL AND GAS PLATFORMS .....	243
<i>Lorrana F. Da Rocha, Lais A. Vitoi, Elisabetta Tedeschi, Danilo I. Brandao</i>	
DIFFERENT METHODS TO CONNECT SWITCHED CAPACITOR LADDER CELLS TO PROVIDE HIGH-STEP-DOWN CONVERTERS .....	251
<i>Neilor Colombo Dal Pont, Telles Brunelli Lazzarin, Brad Lehman</i>	
PUC5 AND MPUC5 BASED SHUNT ACTIVE POWER FILTERS .....	257
<i>Samuel C. S. Júnior, Cursino Jacobina, Edgard L. L. Fabricio, Alvaro De M. Maciel, Artur B. L. K. Neto</i>	
EXPERIMENTAL IMPLEMENTATION OF A SINGLE-PHASE MICROGRID: A FLEXIBLE RESOURCE FOR RESEARCH AND EDUCATIONAL ACTIVITIES.....	265
<i>Augusto M. S. Alonso, Luis De Oro Arenas, Rubens T. Hock, Hildo Guillard, Eduardo V. Liberado, Helmo K. M. Paredes, Flavio A. S. Gonçalves, Fernando P. Marafao</i>	
THREE DIFFERENT APPROACHES TO CONTROL A PHOTOVOLTAIC SYSTEM CONNECTED TO AN UNBALANCED THREE PHASE POWER GRID.....	273
<i>Lamarck Alves Da Cunha, Nady Rocha, Rozério Gaspar De Almeida</i>	
STUDY OF TRAJECTORY DEVIATION OF A SEMI-AUTONOMOUS WHEELCHAIR BASED ON THE INTEGRATION OF SIMULINK® WITH COPPELIASIM® SOFTWARE .....	281
<i>Leonardo Duarte Milfont, José Antenor Pomilio</i>	
A NEW CLASSIFICATION OF HYBRID SWITCHED-LINEAR CONVERTERS .....	289
<i>Nataniel M. Rigo, Dalton L. R. Vidor, José Renes Pinheiro</i>	
OPTIMAL AND ROBUST CONTROL TECHNIQUES APPLIED TO DC-DC BUCK-BOOST CONVERTER.....	297
<i>Ademir Da S. Toledo Júnior, Pedro M. De Almeida, Pedro G. Barbosa, Marcelo De C. Fernandes, Igor D. N. De Souza</i>	
A HYBRID BIDIRECTIONAL DC-DC CONVERTER BASED ON A SEPIC/ZETA CONVERTER WITH A MODIFIED SWITCHED CAPACITOR CELL.....	301
<i>Alex Sander Sebaje, Mário Lúcio Da Silva Martins, Carlos Henrique Illa Font</i>	
BEHAVIOR ANALYSIS OF PV MODULES SUBJECTED TO HIGH-FREQUENCY CURRENT RIPPLES .....	307
<i>Ildenor David S. Junior, Fernando L. M. Antunes, Edilson Mineiro Sá</i>	
A NEW ACTIVE-NEUTRAL-POINT CLAMPED SEVEN-LEVEL BOOST INVERTER .....	315
<i>Ronnan De B. Cardoso, Leonardo R. Limongi, Edison Roberto C. Da Silva</i>	
DC-DC AND DC-AC PARALLEL SWITCHED-LINEAR CONVERTERS.....	322
<i>Nataniel M. Rigo, José Renes Pinheiro, Dalton L. R. Vidor</i>	
ANALYSIS OF CURRENT VARIATION IN A DISTRIBUTION SYSTEM WITH HIGH PENETRATION OF DISTRIBUTED PHOTOVOLTAIC GENERATION .....	329
<i>Patrick T. Barbosa, Luann G. Oliveira Queiroz, Mariana A. Mendes, Oureste E. Batista, Jussara F. Fardin</i>	
MODULATED MODEL PREDICTIVE CONTROL (M2PC) APPLIED TO THREE-PHASE DUAL-CONVERTER-BASED RECTIFIERS .....	335
<i>Ruan C. V. Dos Santos, Victor F. M. B. Melo, Nady Rocha, Edison R. C. Da Silva</i>	

PREDICTIVE TORQUE CONTROL APPLIED TO INDUCTION MACHINE DRIVE SYSTEMS OPERATING UNDER SINGLE-PHASE OPEN-CIRCUIT FAULT .....	343
<i>Pedro H. M. Martins, Victor F. M. B. Melo, Gilielson F. Da Paz, Filipe V. Rocha, Lucas F. M. De Lucena</i>	
ANALYSIS OF MODULATION TECHNIQUES FOR REDUCING COMMON MODE VOLTAGE IN VARIABLE SPEED DRIVE SYSTEMS.....	351
<i>Sofia Maria Almeida Dias, Nady Rocha, Gilielson Figueredo Da Paz, Isaac Soares De Freitas</i>	
INTERLINK MULTI-PORT CONVERTER.....	359
<i>Raphael C. De Oliveira, Aniel S. Morais, Fernando L. Tofoli</i>	
THERMAL MATHEMATICAL MODELING OF PHOTOVOLTAIC INVERTERS AND EXPERIMENTAL VALIDATION.....	367
<i>Geyciane Pinheiro De Lima, Guilherme Cerbatto Schmitt Prym, Karen Barbosa De Melo, Hugo Soeiro Moreira, João Lucas De Souza Silva, Ernesto Ruppert Filho, Marcelo Gradella Villalva</i>	
VV- DTC FOR HEALTHY AND FAULTY OPERATION OF AN ASYMMETRICAL SIX-PHASE INDUCTION MACHINE DRIVE SYSTEM WITH SINGLE NEUTRAL.....	374
<i>Victor F. M. B. Melo, Gilielson F. Da Paz, Isaac S. De Freitas</i>	
MODELING, CONTROL AND OPERATION OF A 10 MW DIRECT-DRIVE WIND ENERGY CONVERSION SYSTEM.....	382
<i>Leandro B. K. Fisch, Marcelo L. Heldwein</i>	
ROBUST CURRENT CONTROL OF THREE-PHASE GRID-CONNECTED CONVERTERS BY USING THE ADRC METHOD .....	390
<i>Diana Alves Campos De Araujo, Joao Amin Moor Neto, Thiago Americano Do Brasil, Josiel Alves Gouvea, Alessandro Rosa Lopes Zachi</i>	
NON-IDEAL MODELING AND ANALYSIS OF A KY NEGATIVE-OUTPUT BOOST CONVERTER.....	398
<i>Silvia H. S. A. Ferreira, Rafael F. Q. Magossi</i>	
A NOVEL NON-INVASIVE METHOD TO MEASURE POWER CONSUMPTION ON SMARTPHONES.....	404
<i>Janisley O. De Sousa, Gustavo C. Fonseca, José W. A. De Oliveira, Ricardo N. Santos</i>	
WORKBENCH PROPOSAL FOR PV CELL CONTROL TEST FOR RESEARCH AND EDUCATIONAL PURPOSES.....	410
<i>Alan Cássio Queiroz Bezerra Leite, Joao Teixeira De Carvalho Neto, Reilta Christine Dantas Maia, Andres Ortiz Salazar, Diego Antônio De Moura Fonsêca</i>	
CONTROL OF HYBRID ENERGY STORAGE SYSTEM FOR PROVIDING GRID SUPPORT SERVICES .....	414
<i>Pedro A. N. Neto, Beatriz Maria W. Soares, João Gonçalves A. Da Silva, Camila S. Gehrke, Italo Roger F. M. P. Da Silva</i>	
MODULAR MULTILEVEL CONVERTER FOR HIGH-PERFORMANCE UPS SYSTEMS .....	419
<i>Micael P. De Lucena, Camila S. Gehrke, Italo Roger F. M. P. Da Silva</i>	
SORTING-ALGORITHM-BASED MODULATION TECHNIQUE FOR VOLTAGE BALANCING THE FLOATING CAPACITORS OF MODULAR MULTILEVEL CONVERTERS.....	425
<i>Micael P. De Lucena, Camila S. Gehrke, Italo Roger F. M. P. Da Silva</i>	

FIVE-LEVEL HYBRID VOLTAGE SOURCE INVERTERS.....	429
<i>Edison Roberto C. Da Silva, Antonio Venancio M. Lacerda Filho, Ronnan De B. Cardoso, Leonardo R. Limongi, Nady Rocha</i>	
MODULATED DIRECT TORQUE CONTROL APPLIED TO INDUCTION MOTOR DRIVE SYSTEMS OPERATING UNDER SINGLE-PHASE OPEN-CIRCUIT FAULT .....	435
<i>Pedro H. M. Martins, Victor F. M. B. Melo, Gilielson F. Da Paz, Filipe V. Rocha</i>	
GRID-FORMING MMC: A COMPARISON BETWEEN SINGLE- AND DUAL-LOOP CONTROL APPROACHES .....	443
<i>Cleiton M. Freitas, Edson H. Watanabe, Luis F. C. Monteiro</i>	
HARDWARE-IN-THE-LOOP LOW VOLTAGE FAULT RIDE THROUGH TESTS OF COMMERCIAL PHOTOVOLTAIC INVERTERS .....	449
<i>Luiz F. R. Menegazzo, Anderson L. N. Severo, Ricardo J. F. Bortolini, Henrique Magnago, Fernanda M. Carnielutti, Lucas V. Bellinaso, Leandro Michels, Humberto Pinheiro</i>	
INSTANTANEOUS ADAPTIVE CONTROLLER BASED ON NEURAL NETWORK FOR BUCK CONVERTER.....	457
<i>Carlúcio Pereira Da Silva, Luiz Fernando Marquez Arruda, Diego Santos Greff</i>	
MODULATED PREDICTIVE CONTROLLER FOR A SINGLE-PHASE TO THREE-PHASE CONVERTERS WITH TWO PARALLEL SINGLE-PHASE RECTIFIERS .....	465
<i>Ruben Da Cruz Ferreira, Sofia Maria Almeida Dias, Nady Rocha, Edison Roberto Cabral Da Silva, Victor Felipe Moura Bezerra Melo</i>	
CONTRIBUTIONS ON SLIDING-MODE CONTROL APPROACH APPLIED FOR SINGLE-PHASE GRID-CONNECTED VOLTAGE SOURCE INVERTERS .....	473
<i>Alan Rodrigues De Sousa, Ricardo Lúcio De Araújo Ribeiro, Thiago De Oliveira Alves Rocha</i>	
DEVELOPMENT OF A CONTROL STRATEGY FOR POWER MANAGEMENT OF AN ELECTRIC VEHICLE HYBRID ENERGY STORAGE SYSTEM.....	479
<i>Matheus J. C. Souza, Lucas F. R. Lago, Silvana T. Faceroli, Márcio C. B. P. Rodrigues</i>	
PARAMETERS ESTIMATION OF PHOTOVOLTAIC MODULES USING OPTIMIZATION METHODS BASED ON METAHEURISTICS.....	486
<i>Danilo De Oliveira Pimentel, Marcelo Cabral Cavalcanti, Fabricio Bradaschia, Eduardo José Barbosa, Leonardo Rodrigues Limongi</i>	
APPLICATION OF A POLY-GPC SYSTEM TO CONTROL A LCL-FILTERED GRID CONVERTER.....	493
<i>Thyago Estrabis, Raymundo Cordero, Moacyr Brito, Walter Suemitsu, Gabriel Gentil, João Anjos</i>	
CHALLENGES FOR LOSS-OF-MAINS PROTECTION SYSTEM IN INVERTER-BASED RESOURCES APPLICATIONS.....	500
<i>Andrei Da Cunha Lima, Anderson Luis Do N. Severo, Luiz Fernando R. Menegazzo, Leandro Michels, Catherine Marquioro De Freitas, Fabricio Andrade Mourinho, Igor Antônio B. De Bitencourt</i>	
DESIGN OF A TWO-STAGE ON-GRID SINGLE-PHASE PHOTOVOLTAIC MICROINVERTER .....	508
<i>Ícaro De Almeida Albuquerque, Susset Guerra Jiménez, Alexander Fernández Correa</i>	
PRICE-BASED DC BUS SIGNALING FOR NANOGUIDS POWER MANAGEMENT.....	516
<i>Edivan L. Carvalho, Lucas V. Bellinaso, Rafael Cardoso, Leandro Michels</i>	



DYNAMIC MODELING OF AN ACTIVE CURRENT DOUBLER RECTIFIER APPLIED TO RESONANT CONVERTERS.....	521
<i>R. L. Oliveira Pinto, E. F. C. Grabowsky, M. L. Heldwein</i>	
ESTIMATION OF ELECTROMAGNETIC LOSSES ASSOCIATED WITH THE BUCK FERRITE CORE INDUCTOR.....	529
<i>Juan Pablo Ochoa Avilés, José Anderson Dos Reis, Eduardo Moreira Vicente, Enio Roberto Ribeiro</i>	
THE DEVELOPMENT OF AN EDUCATIONAL TOOL FOR THE TEACHING OF DISTRIBUTED GENERATION AND RENEWABLE ENERGY CONCEPTS IN ELEMENTARY SCHOOLS.....	535
<i>Lucas Augusto Rabaiolli Mazocco, Ruan Juarez Bulsing, Rafael Concatto Beltrame, Antônio Kaminski Júnior, Tiago Bandeira Marchesan</i>	
GENERALIZED PREDICTIVE CONTROLLER APPLIED IN A BIDIRECTIONAL DC-DC CONVERTER.....	540
<i>Daniel Abreu Macedo Da Silva, André Cavalcante Do Nascimento, Rejane De Barros Araújo, Rogério José De Souza Melo</i>	
IMPEDANCE-BASED STABILITY ANALYSIS FOR A DEAD-BEAT-CONTROLLED GRID- FORMING INVERTER USING CROSS-CORRELATION METHODS.....	546
<i>Igor Alves Maronni, Joel Filipe Guerreiro, José Antenor Pomilio</i>	
DESIGN TRADE-OFFS OF PV DC-DC MODULE INTEGRATED CONVERTER: STANDARDS CONSTRAINTS.....	554
<i>Miréli Binder Vendruscolo, João Paulo Costa Lima, Leandro Michels, Antônio Manuel Santos Spencer Andrade, Marcello Mezaroba</i>	
RECONFIGURABLE RESONANT CONVERTER WITH WIDE OUTPUT VOLTAGE RANGE FOR DC FAST CHARGERS.....	560
<i>Eduardo Valmir De Souza, Marcelo Lobo Heldwein</i>	
DYNAMIC MODELING AND STABILITY ANALYSIS OF RADIAL AND RING DC MICROGRID TOPOLOGIES.....	569
<i>Rafaela Dizaró Silveira, Sérgio Augusto Oliveira Da Silva, Leonardo Poltronieri Sampaio</i>	
EXPERIMENTAL EVALUATION OF A DUAL DC BUSES NANOGRID WITH INTERLINK CONVERTER.....	577
<i>Edivan L. Carvalho, Lucas V. Bellinaso, Rafael Cardoso, Leandro Michels</i>	
PREDICTIVE CURRENT CONTROL APPLIED TO INDUCTION MACHINE DRIVE SYSTEMS OPERATING UNDER SINGLE-PHASE OPEN-CIRCUIT FAULT .....	582
<i>Liane M. De Oliveira, Victor F. M. B. Melo, Gilielson F. Da Paz, Filipe V. Rocha, Edgard L. L. Fabrício</i>	
PWM STRATEGIES WITH REDUCED BEARING CURRENTS FOR FIVE-PHASE MOTORS .....	590
<i>Manoel Severino De Oliveira Neto, Isaac Soares De Freitas, Gilielson Figueredo Da Paz, Kariny Nunes Maia, Caio Luis Guedes De Mello</i>	
COMPARATIVE PERFORMANCE ANALYSIS OF GRID-FORMING STRATEGIES APPLIED TO DISCONNECTABLE MICROGRIDS.....	596
<i>Armando J. G. Abrantes-ferreira, Antonio M. N. Lima</i>	

COMMON-MODE REDUCTION SVPWM FOR FLEXIBLE SERIES/PARALLEL MOTOR DRIVES .....	604
<i>Juliana De A. Wanderley, Raíssa Maria L. Magalhães, Gregory Arthur De A. Carlos, Italo Roger F. M. P. Da Silva</i>	
THREE-PORT ISOLATED DC-DC CONVERTER WITH LQG/LTRI ROBUST CONTROL APPLIED TO PHOTOVOLTAIC SYSTEMS WITH ENERGY STORAGE .....	610
<i>Debora P. Damasceno, Clauson Sales Do N. Rios, Samanta Gadelha Barbosa, Luiz H. S. C. Barreto, Wilkley Bezerra Correia, Fabrício Gonzalez Nogueira, Demercil De S. Oliveira</i>	
A COMPARATIVE ANALYSIS OF THE MAIN METHODS FOR TRACING PV CHARACTERISTIC CURVE THROUGH EXPERIMENTAL TESTS .....	616
<i>João T. De Carvalho Neto</i>	
MODULATION TECHNIQUES APPLIED TO MEDIUM VOLTAGE VARIABLE SPEED DRIVES - SHE AND OPP .....	622
<i>Adriano Da Silva Dias, Rafael Nardelli, Roberto Buerger, Joable Andrade Alves</i>	
CONTROL METHODOLOGIES FOR ENERGY STORAGE SYSTEMS TO SUPPORT VOLTAGE IN DISTRIBUTION GRIDS WITH PHOTOVOLTAIC INSERTION .....	629
<i>Mateus L. Lima, Lilian V. Pinheiro, Janaina G. Oliveira, João Antônio G. Archetti, Leonardo W. Oliveira</i>	
TUNING OF A PI SPEED REGULATOR FOR ELECTRIC DRIVES BY USING PARTICLE SWARM OPTIMIZATION ALGORITHM.....	636
<i>Guilherme F. Dos Santos, Wander G. Da Silva, Volker Pickert, Gélson Da Cruz Júnior</i>	
COMPARISON OF PSO AND SA OPTIMIZATION ALGORITHMS ON THE TUNING OF A PI SPEED REGULATOR FOR ELECTRIC DRIVES.....	644
<i>Guilherme F. Dos Santos, Wander G. Da Silva, Volker Pickert, Gelson Da Cruz</i>	
STEADY STATE ANALYSIS FOR AN ARBITRARY NUMBER OF ZVS PSM FB CONVERTERS IN AN INPUT-PARALLEL OUTPUT-SERIES CONFIGURATION.....	652
<i>Nicolas Eugênio Lima Basquera, Gláucio Roberto Tessmer Hax, Caio Guilherme Da Silva Moraes, Gierry Waltrich, José Antenor Pomilio</i>	
HYBRID PI&APDR CONTROLLER FOR CURRENT REGULATION AND LOW-FREQUENCY RIPPLE REJECTION IN LED DRIVERS.....	658
<i>Maikel F. Menke, Rodrigo V. Tambara, J. Marcos Alonso, Álysson R. Seidel</i>	
SYNCHRONIZATION AND RECONNECTION OF ISLANDED MICROGRIDS.....	666
<i>Paula Stael Silva Barbosa, Raul Procópio Mota, Janaina Gonçalves De Oliveira</i>	
MODELING AND CONTROL OF INTERLEAVED BOOST CONVERTER FOR PHOTOVOLTAIC APPLICATIONS .....	670
<i>Marcelo Lopes Vieira Bezerra, Rafael Rocha Marias</i>	
SMALL SIGNAL ANALYSIS FOR AN ARBITRARY NUMBER OF ZVS PSM FB CONVERTERS IN AN INPUT-PARALLEL OUTPUT-SERIES CONFIGURATION.....	678
<i>Nicolas Eugênio Lima Basquera, Gláucio Roberto Tessmer Hax, Caio Guilherme Da Silva Moraes, Gierry Waltrich, José Antenor Pomilio</i>	
COMPOSITE DC-DC CONVERTER WITH BIPOLAR/BIDIRECTIONAL CURRENT-FED PUSH-PULL VOLTAGE REGULATOR.....	683
<i>Tiago Miguel Klein Faistel, Henrique Jank, Gustavo Colpes Ribeiro, Mario Lucio Da Silva Martins, Luiz Antonio Correa Lopes</i>	

FCS-MPC APPLIED TO MULTILEVEL HYBRID ACTIVE POWER FILTER FOR REACTIVE POWER AND HARMONICS COMPENSATION .....	688
<i>João G. L. Foster, Rondineli R. Pereira, Robson B. Gonzatti, Bruno P. B. Guimaraes, Guilherme G. Pinheiro, Wilson C. Sant'Ana</i>	
NEURAL-NETWORK-BASED APPROACH APPLIED TO HARMONIC COMPONENT ESTIMATION IN MICROGRIDS .....	696
<i>Luiz Gustavo Reis Bernardino, Claudionor Francisco Do Nascimento, Roberto Fernandes Tavares Neto, Wesley Angelino De Souza, Fernando Pinhabel Marafão</i>	
A NOVEL FAMILY OF SINGLE SWITCH HIGH STEP-UP DC/DC CONVERTERS FOR PV APPLICATIONS.....	702
<i>Aline V. C. Pereira, Marcelo C. Cavalcanti, Gustavo M. S. Azevedo, Fabricio Bradaschia, Márcio R. Carvalho</i>	
ANALYSIS OF IMPACTS ON THE FREQUENCY OF ELECTRICAL SYSTEMS CAUSED BY DISTRIBUTED ENERGY RESOURCES.....	708
<i>Thiago R. Barros, João Antônio G. Archetti, Larissa M. Monteiro, Janaina G. Oliveira</i>	
OPTIMAL CONTROL DESIGN FOR PROPORTIONAL-RESONANT CONTROLLERS WITH ACTIVE DAMPING APPLIED TO GRID-CONNECTED CONVERTERS .....	716
<i>Everson Mattos, Lucas Cielo Borin, Caio Ruviano Dantas Osório, Gustavo Guilherme Koch, Vinicius Foletto Montagner</i>	
COMPARATIVE ANALYSIS OF ALTERNATIVES FOR VIRTUAL IMPEDANCE REPRESENTATION IN A SMALL-SIGNAL REDUCED-ORDER MODEL FOR LOW-VOLTAGE ISLANDED AC MICROGRIDS .....	721
<i>Sebastián De J. Manrique Machado, Sérgio Augusto Oliveira Da Silva, José Roberto Boffino De Almeida Monteiro</i>	
A SIMPLE AND POWERFUL MODEL PREDICTIVE DIRECT POWER CONTROL FOR DFIG.....	727
<i>Felipe S. Guedes, Nady Rocha, Alvaro M. Maciel, Alfeu J. Sguarezi Filho</i>	
SYNCHRONOUS GENERATOR STATIC EXCITATION CONTROL USING TWO-SWITCH FORWARD CONVERTER .....	735
<i>Raul Erd Piveta, Pedro Da Silveira Vianna, Lucas Giuliani Scherer, Robinson Figueiredo De Camargo, Cassiano Rech, Felipe Bovolini Grigoletto</i>	
DEVELOPMENT OF A HYBRID MICROGRID FOR POWER GENERATION THROUGH THE INTERCONNECTION OF SOURCES WITH A PUSH-PULL CONVERTER.....	743
<i>Maicon Luís Flach, Lucas Giuliani Scherer, Robinson Figueiredo De Camargo</i>	
ISOLATED HIGH GAIN DC-DC CONVERTER WITH LOW INPUT AND OUTPUT CURRENT RIPPLE FOR PHOTOVOLTAIC SYSTEM APPLICATIONS.....	751
<i>Anderson P. Pontes, Hugo Dos S. Vieira, Edilson M. S. Júnior</i>	
DESIGN OF ROBUST CONTROLLERS APPLIED TO DC-DC CONVERTERS WITH UNCERTAIN PARAMETERS OPTIMIZED BY METAHEURISTICS.....	759
<i>Lucas Cielo Borin, Everson Mattos, Renan Medke, Caio Ruviano Dantas Osório, Gustavo Guilherme Koch, Vinicius Foletto Montagner</i>	
A NEW POSITIVE-SEQUENCE DETECTOR PHASE-LOCKED LOOP ALGORITHM FOR DC OFFSET REJECTION .....	764
<i>Moacyr A. G. De Brito, Artur A. De Carvalho, Ruben B. Godoy, Anderson S. Volpato, Luís F. S. C. Pereira, Edson A. Batista</i>	

MODELLING AND CONTROLLER DESIGN FOR Y-SOURCE INVERTER APPLIED IN STAND-ALONE PV SYSTEM .....	769
<i>Marcus V. M. Rodrigues, Flavio A. Serrão Gonçalves, Rafael Dos Santos, Fernando P. Marafão</i>	
HIGH GAIN HYBRID DC-DC CONVERTER WITH SWITCHED CAPACITOR FOR PHOTOVOLTAIC SYSTEMS APPLICATIONS .....	774
<i>Brenna Theodora Machado Matos, Mauricio Albuquerque Moura, Edilson Mineiro Sá Junior, Kleber Cesar Alves De Souza</i>	
SMALL-SIGNAL MODELING OF THE BOOST-BUCK FOR SINGLE-PHASE GRID CONNECTED PHOTOVOLTAIC SYSTEMS .....	779
<i>Mauricio Taconelli, Paulo Fernando Silva, Ricardo Quadros Machado, Amilcar Flamarion Querubini Gonçalves</i>	
ZVS-PWM ACTIVE-CLAMPING DIFFERENTIAL TAPPED-INDUCTOR BOOST CONVERTER.....	787
<i>Tomás Adão Gonçalves, Tiago Miguel Klein Faistel, António M. S. S. Andrade, Mário L. Da Silva Martins</i>	
POWER LOSSES EVALUTATION OF HYBRID SEMICONDUCTOR MODULES FOR PHOTOVOLTAIC INVERTERS .....	793
<i>Luan Millard Corrêa Brasil, Fábio De Almeida Pongelupe, Tomás Perpétuo Corrêa, Heverton Augusto Pereira, Allan Fagner Cupertino</i>	
ZERO-CURRENT SWITCHING CLAMPED CURRENT CONVERTER .....	801
<i>Vinicius Freire Bezerra, Montiê Alves Vitorino, Jens Friebe</i>	
DELTA-CHB STATCOM WITH REDUCED ENERGY STORAGE REQUIREMENTS BASED ON THIRD HARMONIC INJECTION .....	808
<i>Dayane Do Carmo Mendonça, João Marcus Soares Callegari, Allan Fagner Cupertino, Heverton Augusto Pereira, Seleme Isaac Seleme Júnior, Remus Teodorescu</i>	
A REVIEW AND PERFORMANCE EVALUATION OF COMPLEX REPETITIVE CONTROLLERS IN GRID-CONNECTED INVERTERS .....	815
<i>Rafael C. Neto, Francisco A. S. Neves, Helber E. P. De Souza, Ygo N. Batista, Márcio R. S. De Carvalho, Eduardo A. O. Barbosa</i>	
EXPLICIT MPC WITH REGION ELIMINATION: A CASE STUDY ON A BUCK CONVERTER.....	823
<i>Viviane Louzada Wisniewski, Emilio T. Maddalena, Ruben Barros Godoy</i>	

**Author Index**