

REFERENCES

- [1] Bor-Ren Lin, Hsin-Hung Lu, Shuh-Chuan Tsay, "Control Technique for High Power Factor Multilevel Rectifier," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 37, No. 1, January 2001, pp. 226 – 240.
- [2] B .R. Lin, T. C. Wei, "A Novel Inverter for Harmonics Elimination and Reactive Power Compensation," *IEEE Transactions on Power Delivery*, Vol.19, No.3, July 2004, pp 1449-1456.
- [3] Jih-Sheng Lai, and Fang Zheng Peng, "Multilevel Converters-A new Breed of Power Converters," *IEEE Transactions on Industry Applications*, Vol. 32, No. 3, May/June 1996, pp. 509 – 515.
- [4] A. Nabae, I. Takahashi, and H. Akagi, "A New Neutral-Point Clamped PWM inverter," *Proceedings of the Industry Applications Society Conference*, September/October 1980, pp. 761 – 766.
- [5] M. Fracchia, T. Ghiara, M. Marchesoni, and M. Mazzucchelli, "Optimized Modulation Techniques for the Generalized N-Level Converter," *Proceedings of the IEEE Power Electronics Specialist Conference*, Vol.2, 1992, pp. 1205 – 1213.
- [6] F. Z. Peng, "A Generalized Multilevel Inverter Topology with Self Voltage Balancing," *Proceedings of the IEEE Industry Applications Society Conference*, Vol.3, October 2000, pp. 2024 – 2031.
- [7] X. Yuan and I. Barbi, "Fundamentals of a New Diode Clamping Multilevel Inverter," *IEEE Transactions on Power Electronics*, Vol.15, No. 4, July 200, pp. 711 – 718.
- [8] M. D. Manjrekar, T.A. Lipo. "A Hybrid Multilevel Inverter Topology for Drive Applications," *IEEE – APEC Conference Record*, Vol. 2, 1998, pp. 523 – 539.
- [9] S. Ogasawara, J. Takagaki, H. Akagi, and A. Nabae, "A Novel Control Scheme of a Parallel Current-Controlled PWM Inverter," *IEEE Transactions on Industry Applications*, Vol. 28, No. 5, September/October 1992, pp. 1023 – 1030.
- [10] F. Ueda, M. Asoa, and K. Tsuboi, "Parallel-Connections of Pulsewidth Modulated Inverters Using Current Sharing Reactors," *IEEE Transactions on Power Electronics*, Vol.10, No.6, November 1995, pp. 673 – 679.
- [11] H. Stemmler, and P. Guggenbach, "Configurations of High-Power Voltage Source Inverter Drives," *Proceedings of the European Conference on Power Electronics and Applications*, Vol. 5, September 1993, pp. 7 – 14.

- [12] T. Kawabatta, Y. Kawabata, and K. Nishiyama, "New Configuration of High-Power Inverter Drives," *Proceedings of the IEEE International Symposium on Industrial Electronics*, Vol. 2, June 1996, pp. 850 – 855.
- [13] Y. Fukuta, and G. Venkataramanan, "DC Bus Ripple Minimization In Cascaded H – Bridge Multilevel Converters under Staircase Modulation," *Proceedings of IEEE IAS Conference*, Vol. 3, October 2002, pp. 1988 – 1993.
- [14] T. Bruckner and D. G. Holmes, "Optimal Pulse Width Modulation for Three-Level Inverters," *Proceedings of the IEEE Power Electronics Specialist Conference*, Vol. 1, June 2003, pp. 165-170.
- [15] B. P. McGrath, D. G. Holmes, and T. A. Lipo, "Optimized Space Vector Switching Sequences for Multilevel Inverters," *IEEE Transactions on Power Electronics*, Vol. 18, No. 6, November 2003, pp. 1293-1301.
- [16] B. P. McGrath and D. G. Holmes, "Multicarrier PWM Strategies for Multilevel Inverters," *IEEE Transactions on Industrial Electronics*, Vol. 49, No. 4, August 2002, pp. 858-867.
- [17] D. G. Holmes, "The General Relationship Between Regular-Sampled Pulse-Width-Modulation and Space Vector Modulation for Hard Switched Converters," *Proceedings of the Industry Applications Society Conference*, Vol. 1, October 1992, pp. 1002-1009.
- [18] F. Wang, "Sine-Triangle Versus Space-Vector Modulation for Three-Level PWM Voltage-Source Inverters," *IEEE Transactions on Industry Applications*, Vol. 38, No. 2, March/April 2002, pp. 500-506.
- [19] S. Ogasawara, H. Akagi, "A Vector Control System Using a Neutral-Point-Clamped Voltage Source PWM Inverter," *IEEE-IAS Conference Record*, 1991, pp. 422 – 427.
- [20] J. Steinke, "Switching Frequency Optimal PWM Control of a Three-Level Inverter," *IEEE Transactions on Power Electronics*, July 1992, Vol. 7, No. 3.
- [21] S. Ogasawara, H. Akagi, "Analysis of Variation of Neutral point Potential in Neutral-Point-Clamped Voltage Source PWM Inverters," *IEEE-IAS Conference Record*, 1993, pp. 965 - 970.
- [22] G. Carrara, S. Garadella, M. Marchesoni, R. Salutari, G. Sciutto, "A New Multilevel PWM Method: A Theoretical Analysis," *IEEE Transactions on Power Electronics*, Vol. 7, No. 3, July 1992, pp. 497 – 505.
- [23] Leon M. Tolbert, Thomas G. Habetler, "Novel Multilevel Inverter Carrier-Based PWM Methods," *IEEE IAS 1998 Annual Meetings*, St. Louis, Missouri, October 10-15, 1998, pp. 1424-1431.

- [24] Hongyan Wang, Yan Deng, Xiangning He, "Novel Carrier-based PWM Method with Voltage Balance for Flying Capacitor Multilevel Inverters," *35th Annual IEEE Power Electronics Specialists Conference*, Aachen, Germany, 2004, pp. 4418 – 4422.
- [25] Giri Venkataramanan, and Ashish Bendre. "Reciprocity-Transposition-Based Sinusoidal Pulsewidth Modulation for Diode-Clamped Multilevel Converters," *IEEE Transactions on Industrial Electronics*, Vol. 49, No. 5, October 2002, pp. 1035 – 1047.
- [26] B. Velaerts, P. Mathys, G. Bingen, "New Developments of 3-Level PWM Strategies," *EPE*, Aachen, 1989, pp. 411 - 416.
- [27] Dae-Wook Kang, Yo-Han Lee, Bum-Seok Suh, Chang-Ho Choi, and Dong-Seok Hyun, "An Improved Carrier-Based SVPWM Method Using Leg Voltage Redundancies in Generalized Cascaded Multilevel Inverter Topology," *IEEE Transactions on Power Electronics*, Vol. 18, No. 1, January 2003, pp 180 – 187.
- [28] J. K. Steinke, PWM Control of a Three-Level Inverter – Principles and practical experience," *International Conference on Power Electronics & Variable Speed Drives*, 1990, pp. 98 - 103.
- [29] Giuseppe Carrara, Simone Gardella, Mario Marchesoni, Raffaele Salutati, and Giuseppe Sciotto, "A New Multilevel PWM Method: A Theoretical Analysis," *IEEE Transactions on Power Electronics*, Vol. 7, No. 3, July 1992.
- [30] Hongyan Wang, Yan Deng, Rongxiang Zhao, Xiangning He, "Relationship Between Flying Capacitor Multilevel Inverter PWM Methods and Switching Loss Minimized PWM Method for Flying Capacitor Multilevel inverter," *35th Annual IEEE Power Electronics Specialists Conference*, Aachen, Germany, 2004, pp. 4418 - 4422.
- [31] H. L. Liu, G. H. Cho, "Three-Level Space Vector PWM in Low Index Modulation Region Avoiding Narrow Pulse Problem," *IEEE Transactions on Power Electronics*, Vol. 9, No .5, September 1994, pp. 481 – 486.
- [32] Sergio Busquets-Monge, Josep Bordonau, Dushan Boroyevich, " The Nearest Three Virtual Space Vector PWM- A Modulation for the Comprehensive Neutral-Point Balancing in the Three-Level NPC Inverter," *IEEE Power Electronics Letters*, Vol. 2, No. 1, March 2004, pp 11-15.
- [33] C. Newton, M. Sumner, "Neutral Point Control for Multi-Level Inverters: Theory, Design and Operation Limitations," *IEEE-IAS Conference Record*, 1997, pp. 1336 – 1343.

- [34] Josep Pou, Rafael Pindado, Dushan Boroyevich, "Limits of the Neutral-Point Balance in Back-to-Back-Connected Three-Level Converter," *IEEE Transactions on Power Electronics*, Vol. 19, No. 3, May 2004, pp. 722 - 729.
- [35] Fei Wang, "Sine-Triangle versus Space-Vector Modulation for Three-Level PWM Voltage-Source Inverters," *IEEE Transactions on Industry Application*, Vol. 38, No. 2, March/April 2002, pp. 500 – 506.
- [36] Dongsheng Zhou, Didier G. Rouaud, "Experimental Comparisons of Space Vector Neutral Point Balancing Strategies for Three-Level Topology," *IEEE Transactions on Power Electronics*, Vol. 16, No. 6, November 2001, pp 872-879.
- [37] Giri Venkataramanan, Ashish Bendre, "Radial State Space Vector Modulation – A new space vector technique for reducing dc link capacitor harmonic currents in three level converter," *IEEE IAS conference Record*, 2003, pp. 684 - 691.
- [38] B. P. McGrath, D. G. Holmes, and T. A. Lipo, "Optimized Space Vector Switching Sequences for Multilevel Inverters," *IEEE Transactions on Power Electronics*, Vol. 18, No. 6, November 2003, pp. 1293-1301.
- [39] D. G. Holmes, P. C. Loh, G.H.H. Pang, "Multi-level discontinuous pulsewidth modulation: common mode voltage minimization analysis," *IEE Proceedings Power Applications*, Vol. 151, No. 4, July 2004, pp 477 - 486.
- [40] Lars Helle, Stig Munk-Nielsen and Prasad Enjeti, "Generalized Discontinuous DC-Link Balancing Modulation Strategy for Three-Level Inverters," *Power Conversion Conference*, Osaka, 2002, pp. 359 – 366.
- [41] N. Celanovic, D. Boroyevich, "A comprehensive study of neutral-point voltage balancing problem in three-level neutral-point-clamped voltage source PWM inverters," *IEEE Transactions on Power Electronics*, Vol. 15, No. 2, March 2002, pp. 242 – 249.
- [42] N. Celanovic, I. Celanovic, and D. Boroyevich, "The feedforward method of controlling three-level diode clamped converters with small dc-link capacitors," *Proceedings IEEE PESC 2000*, Vol. 3, June 2001, pp. 1357 – 1362.
- [43] J. Pou, D. Boroyevich, and R. Pindado, "New feedforward space-vector PWM method to obtain ac output voltages in a three-level neutral-point-clamped converter," *IEEE Transactions on Industrial Electronics*, Vol. 49, No. 5, October 2002, pp. 1026 – 1034.

- [44] Q. Song, W. Liu, Q. Yu, X. Xie, and Z. Wang, "A neutral-point potential balancing algorithm for three-level NPC inverters using analytically injected zero-sequence voltage," *Proceedings of IEEE Power Electronics Specialists Conference*, 1997, pp. 942 – 948.
- [45] Dongsheng Zhou, "A Self-Balancing Space Vector Switching Modulator for Three-Level Motor Drives," *IEEE Transactions on Power Electronics*, Vol. 17, No. 6, November 2002, pp. 1024 - 1031.
- [46] Giuseppe Carrara, Simone Gardella, Mario Marchesoni, Raffaele Salutati, and Giuseppe Sciotto, "A New Multilevel PWM Method: A Theoretical Analysis," *IEEE Transactions on Power Electronics*, Vol. 7, No. 3, July 1992, pp. 497 – 505.
- [47] Jurgen K. Steinke, "Switching Optimal PWM Control of a Three-Level Inverter," *IEEE Transactions on Power Electronics*, Vol. 7, No. 3, July 1992, pp 487-496.
- [48] G. H. Bode and D. G. Holmes, "Implementation of Three Level Hysteresis Current Control for a Single Phase Voltage Source Inverter," *IEEE - IAS Conference Record*, 2000, pp. 1370 - 1376.
- [49] N. Celanovic, D. Boroyevich, "A fast space-vector modulation algorithm for multilevel three-phase converter," *IEEE Transactions on Industry Applications*, Vol. 37, No. 2, March/April 2002, pp. 637 – 641.
- [50] G. Sinha and T. A. Lipo, "A Four Level Rectifier Inverter System for Drive Applications," *IEEE Transactions on Industry Applications*, Vol. 4, No. 1, January/February 1998, pp. 66 – 74.
- [51] Madhav D. Manjrekar, Thomas A. Lipo, "A hybrid multilevel inverter topology for drive applications," *IEEE Transaction on Industry Applications*, Vol. 36, No. 3, May/June 2000, pp. 834 – 841.
- [52] Omar Bouhali, El Madjid Berkouk, Bruno Francois, Christophe Saudemont, "Direct Generalized Modulation of Electrical Conversions Including Self Stabilization of the DC-Link for a Single Phase Multilevel Inverter Based AC Grid Interface," *35th Annual IEEE Power Electronics Specialists Conference*, Aachen, Germany, 2004, pp. 1385 – 1391.
- [53] M Angeles Martin Prats, L. G. Franquelo, R. Portillo, J. I. Leon, E. Galvan, and J.M. Carrasco, "A 3-D Space Vector Modulation Generalized Algorithm for Multilevel Converters," *IEEE Power Electronics Letters*, 2003, pp. 1 – 5.

- [54] Remus Teodorescu, Frede Blaabjerg, John K. Pedersen, Prasad Enjeti, E. Cengelci, "Space Vector Modulation Applied to Modular Multilevel Converters."
- [55] Jae Hyeong Seo, Chang Ho Choi, and Dong Seok Hyun, "A New Simplified-Vector PWM Method for Three-Level Inverters," *IEEE Transactions on Industrial Electronics*, Vol. 16, No. 4, July 2001.
- [56] Leon M. Tolbert, Fang Z. Peng, "Multilevel Converters for Large Electric Drives," *APEC'98*, Anaheim, California, February, 15-19, 1998, pp. 530-536.
- [57] B. R. Lin, T. C. Wei, "Unidirectional three-phase rectifier with high power factor," *IEE Proceedings, Power Applications*, Vol. 151, No. 2, March 2004, pp 215-222.
- [58] Bor-Ren Lin, Yi-Lang Hou, and Huann-Keng Chiang, "Implementation of Three-level Rectifier for Power Factor Correction," *IEEE Transactions on Power Electronics*, Vol. 15, No. 5, September 2000, pp.891 – 900.
- [59] B. R. Lin, D. J. Chen, "Implementation of a single-phase three-leg AC/AC converter with neutral-point diode-clamped scheme," *IEE Proceedings of Power Applications*, Vol. 149, No. 6, November 2002, pp. 225 – 234.
- [60] V. T. Somasekhar, K. Gopakumar, "Three-level inverter configuration cascading two two-level inverters," *IEE Proceedings on Power Applications*, Vol. 150, No. 3, May 2003, pp. 245 - 254.
- [61] J. Shen, N. Butterworth, "Analysis and design of a three-level PWM converter system for railway-traction applications," *IEE Proceedings on Power Applications*, Vol. 144, No. 5, September 1997, pp. 357 - 371.
- [62] B. R. Lin, T. C. Wei, "Unidirectional three-phase rectifier with high power factor," *IEE Proceedings, Power Applications*, Vol. 151, No. 2, March 2004, pp 215-222.
- [63] B. R. Lin and T. Y. Yang, "Single-phase half-bridge rectifier with power factor correction," *IEE Proceedings, Power Applications*, Vol. 151, No. 4, July 2004, pp 443 - 450.
- [64] B.R. Lin, T.C. Wei, and H.K. Chiang, "Novel AC Line Conditioner for Power Factor Correction," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 40, No. 1, January 2004, pp. 168 – 179.

- [65] B. R. Lin, and Y. L. Hou, "High-power-factor single-phase capacitor clamped rectifier," *IEE Proc.-Electr. Power Appl.*, Vol. 148, No. 2, March 2001, pp. 214 – 224.
- [66] B. R. Lin, and T. L. Hung, "Single-phase half-bridge converter topology for power quality compensation," *IEE Proc.-Electr. Power Appl.*, Vol. 149, No. 5, September 2002, pp. 351 – 359.
- [67] Bor-Ren-Lin, Ta-Chang-Wei, "Implementation of a Single-Phase AC/AC Converter Based on Neutral-Point-Clamped Topology," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 39, No. 2, April 2003, pp. 625 – 633.
- [68] Joan Salaet, Salvador Alepuz, Alex Gilabert, Josep Bordonau, Juan Peracaula. "D-Q Modeling and Control of a Single-Phase Three-Level Boost Rectifier with Power Factor Correction and Neutral-Point Voltage Balancing," *IEEE Transactions on Industrial Electronics*, Vol. 36, No. 3, May/June 2000.
- [69] Bor-Ren Lin, Yung-Chuan Lee, Tsung-Yu Yang, "Implementation of a Three-Phase High-Power-Factor Rectifier with NPC Topology," *IEEE Transactions on Aerospace and Electronic Systems*, Vol. 40, No. 1, January 2004, pp. 180 – 189.
- [70] Mariusz Malinowski, Marek Jasinski, and Marian P. Kazmierkowski, "Simple Direct Power Control of Three-Phase PWM Rectifier Using Space-Vector Modulation (DPC-SVM)," *IEEE Transactions on Industrial Electronics*, Vol. 51, No. 2, April 2004, pp. 447 – 454.
- [71] B. R. Lin, Y. C. Lee and T. Y. Yang, "Experimental verification of a three-phase multilevel rectifier with reduced number of power switches," *IEE Proc.-Electr. Power Appl.*, Vol. 150, No. 5, September 2003.
- [72] B. R. Lin and T. C. Wei, "Analysis and implementation of a three-phase two-leg neutral point clamped converter based on space vector PWM for power factor correction," *IEE Proc.-Electr. Power Appl.*, Vol. 151, No. 1, January 2004, pp. 38 – 46.
- [73] Keith A. Corzine, James R. Baker, "Reduced-Parts-Count Multilevel Rectifiers," *IEEE Transactions on Industrial Electronics*, Vol. 49, No. 4, August 2002, pp. 766 – 774.
- [74] B. R. Lin and T. C. Wei, "Current sensorless three-phase NPC converter with less power switches," *IEE Proc.-Electr. Power Appl.*, Vol. 150, No. 5, September 2003, pp. 555 – 560

- [75] Enjeti P. N. Rahman, and Jakkli, "Economic single-phase to three-phase converter topologies for fixed and variable frequency output," *IEEE Transaction on Power Electronics*, Vol.8, No. 3, 1993.
- [76] Y. Zhao, Y. Li, and T. A. Lipo, "Force commutated three level boost type rectifier," *IEEE Transaction on Industrial Applications*, Vol. 31, January/February 1995, pp. 155 – 161.
- [77] Gerardo Escobar, Aleksander M. Stankovic, and Paolo Mattavelli, "An Adaptive Controller in Stationary Reference Frame for D-Statcom in Unbalanced Operation," *IEEE Transactions on Industrial Electronics*, Vol. 51, No. 2, April 2004, pp. 401 – 409.
- [78] S. Fukuda and T. Yoda, "A Novel current-tracking method for active filters based on a sinusoidal internal model," *IEEE Transaction on Industrial Applications*, Vol. 37, No. 4, May/June 2001, pp. 888 – 895.
- [79] P. T. Cheng, S. Bhattacharyam, and D. Divan, "Control of square-wave inverters in high power hybrid active power filter systems," *IEEE Transactions on Industrial Applications*, Vol. 34, No. 2, May/June 1998, pp. 458 – 472.
- [80] Seong-Jeub Jeon, Fred C. Lee, "Three Control Strategies for a Three-Leg AC-DC Converter Under Unbalanced AC Voltage Condition," *IAS Conference 2003*, pp. 186 – 191.
- [81] Marian P. Kazmierkowski, and Luigi Malesani, "Current Control Techniques for Three-Phase Voltage-Source PWM Converters: A Survey," *IEEE Transactions on Industrial Electronics*, Vol. 45, No. 5, October 1998, pp. 691 – 703.
- [82] Cursino B Jacobina and Edison Roberto Cabral da Silva, "An Induction Motor Drive System with Improved Fault Tolerance," *IEEE Transactions on Industry Application*, Vol. 37, No. 3, pp. 873-879, May/June 2001.
- [83] Olorunfemi Ojo, "The Generalized Discontinuous PWM Modulation Scheme for Three Phase Voltage Source Inverters," *To appear in the IEEE Trans. on Industrial Electronics*, 2004.
- [84] R. Stengel, *Stochastic Optimal Control*, John Wiley, New York, 1986.
- [85] Cursino B Jacobina, Edison Roberto Cabral da Silva, "Current Control of Unbalanced Electrical Systems," *IEEE Transactions on Industrial Electronics*, Vol. 48, No. 3, pp. 517-524, June 2001.
- [86] G. Sinha and T. A. Lipo, "A Four Level Rectifier Inverter System for Drive Applications," *IEEE Transactions Industry Applications*, Vol. 4, No. 1, January/February 1998, pp. 66-74.

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