



Project 5842

Power Electronic Converters with Synchronized Modulation for Electric Vehicles and for Photovoltaic Systems

Institute of Power Engineering of the Academy of Sciences of Moldova

1 March 2014 – 29 February 2016

Chisinau, Moldova
15 December, 2014

Project 5842: Power Electronic Converters with Synchronized Modulation for Electric Vehicles and for Photovoltaic Systems

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Project 5842: Power Electronic Converters with Synchronized Modulation for Electric Vehicles and for Photovoltaic Systems

General Information

- Project Manager: Dr. (Habilitat) of Sc. Valentin Olesciuk
- Project technical area: Environment and Non-Nuclear Energy Research
- Funding Parties: USA – 50%, European Union – 50%
- Project Objectives: Development, dissemination and adaptation of novel strategies, schemes and algorithms of synchronized space-vector modulation for control of perspective topologies of power converters for electric transport and for photovoltaic installations
- Current Percent of FWS: 100%

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Work Schedule for the First Year of the Project

I. Elaboration of schemes and algorithms of synchronized modulation for control of power conversion systems for electric vehicles (March 2014 – February 2015):

1. Development and dissemination of algorithms of synchronized space-vector modulation for control of traction drive system on the base of dual three-phase inverters (March – May 2014);

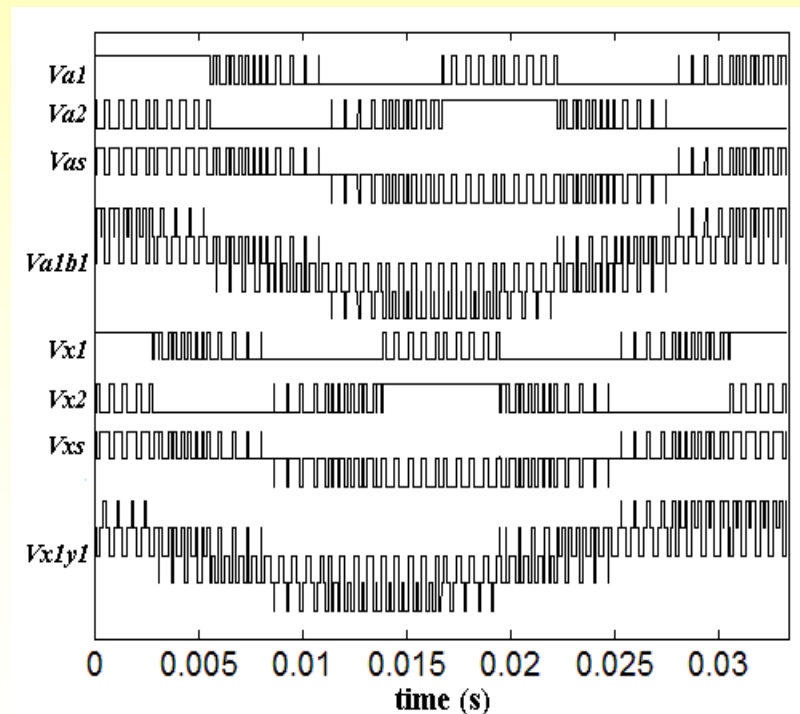
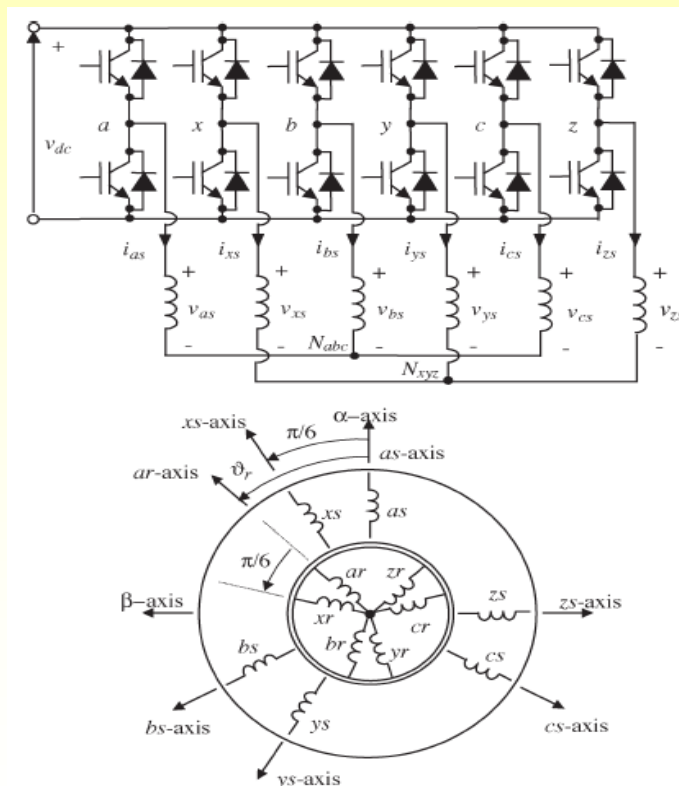
2. Modification and adaptation of basic schemes of synchronized modulation for control of electric vehicle drive on the base of cascaded converters (June – August 2014);

3. Dissemination of algorithms of synchronized space-vector modulation for control of asymmetrical traction drive with two dc-sources (September – November 2014).

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Technical Report (Quarter 1)

Dual Three-Phase Traction Drive Controlled by Algorithms of Synchronized Pulsewidth Modulation

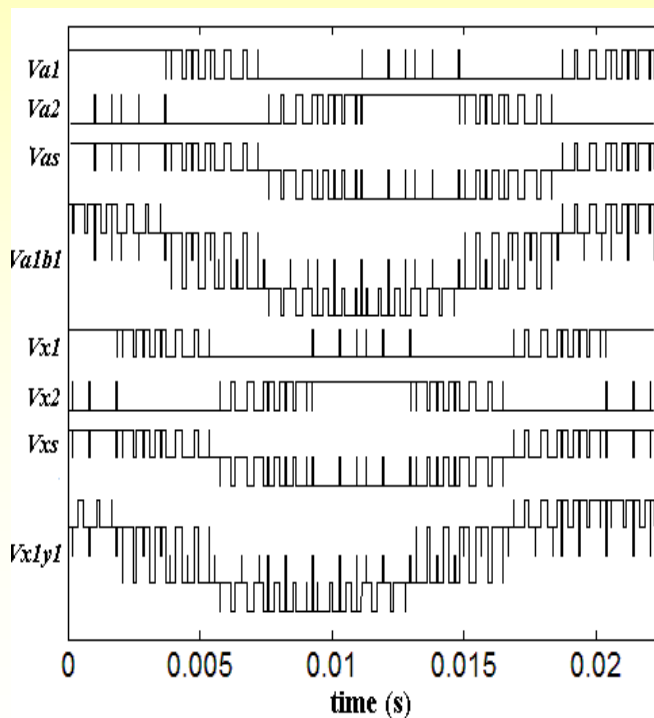


Quarter-wave symmetry of the phase voltage

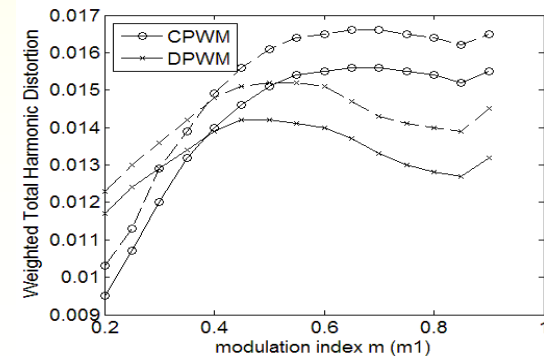
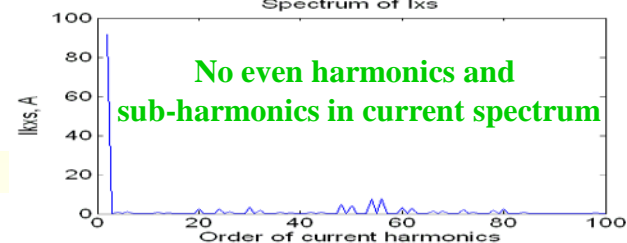
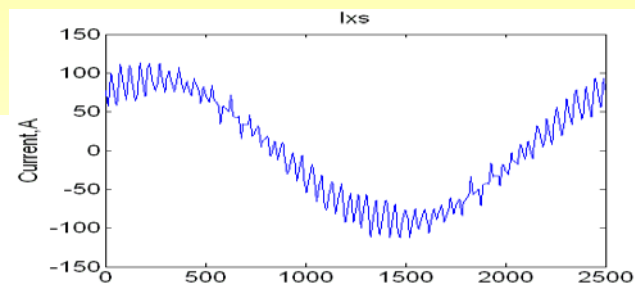
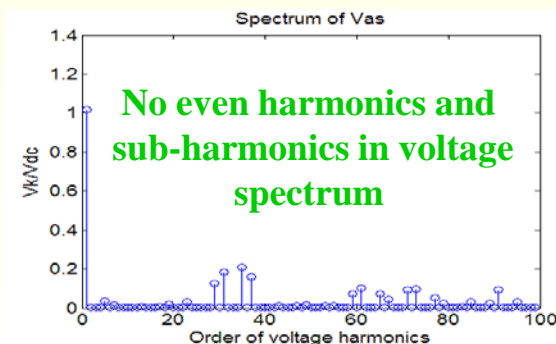
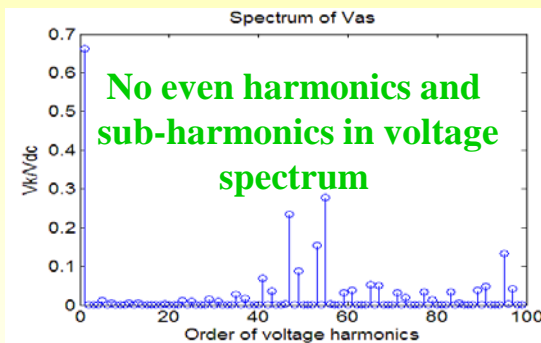
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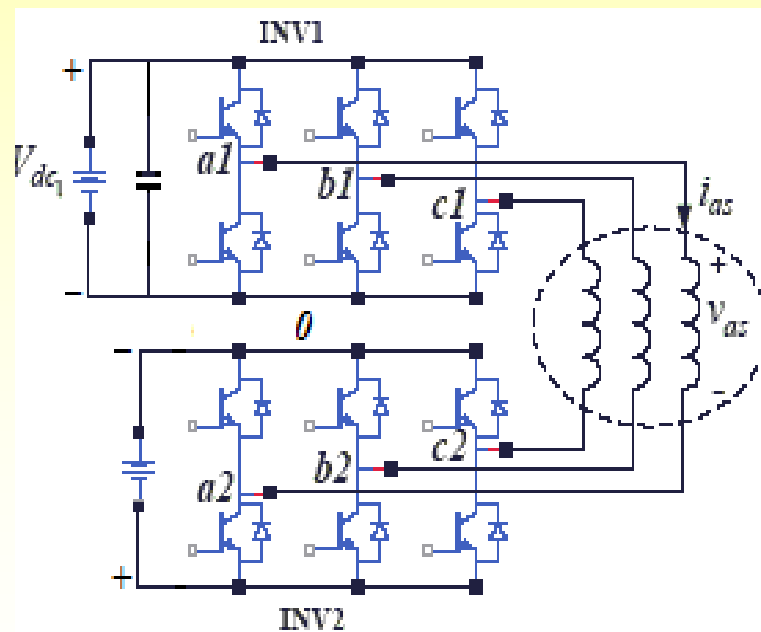
Quarter-wave symmetry of the phase voltage



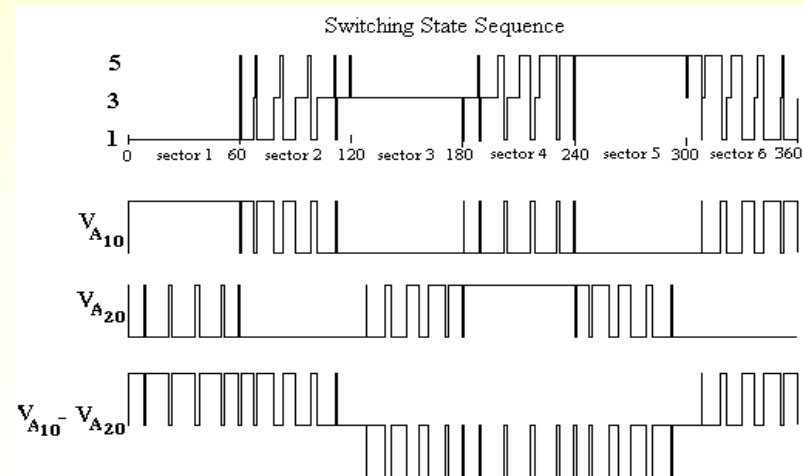
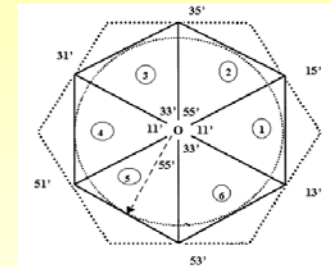
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Technical Report (Quarter 2)

Cascaded Inverters Controlled by Algorithms of Synchronized Modulation for Traction Drive System



Basic voltage space-
vectors providing
elimination of
common-mode
voltage



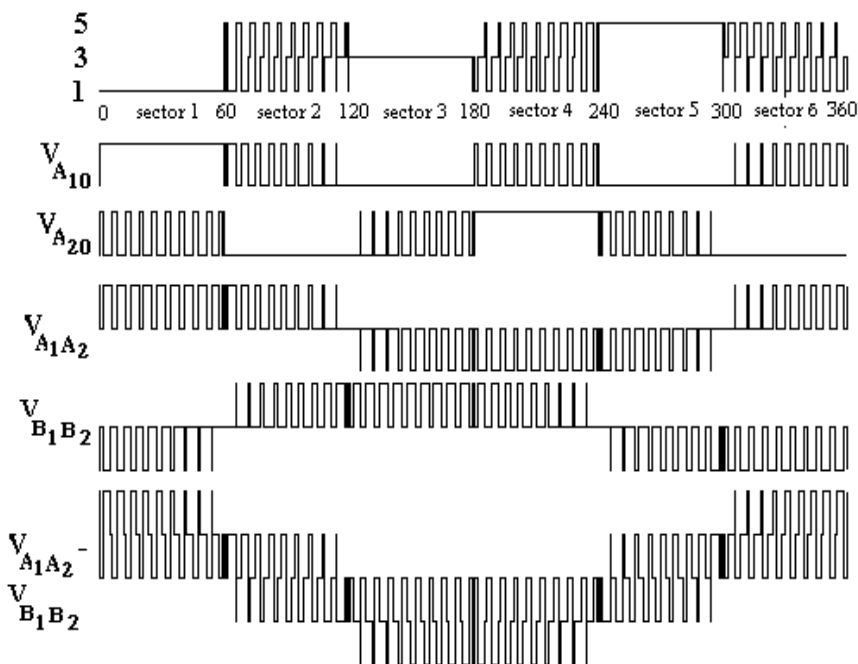
Control and output signals of drive system
on the base of cascaded inverters

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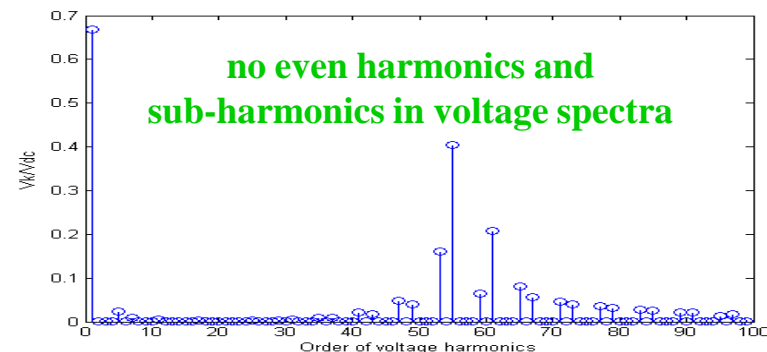
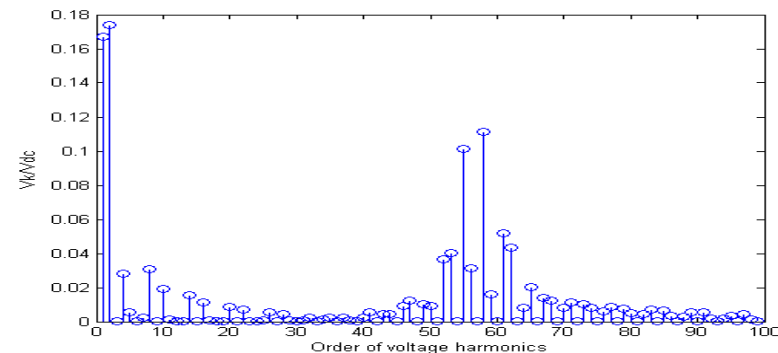
Technical Report (Quarter 2)

Cascaded Inverters Controlled by Algorithms of Synchronized Modulation for Traction Drive System

Switching State Sequence



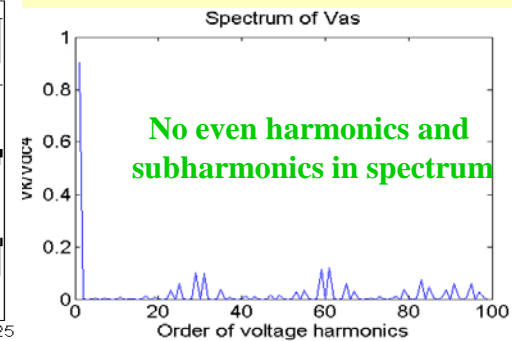
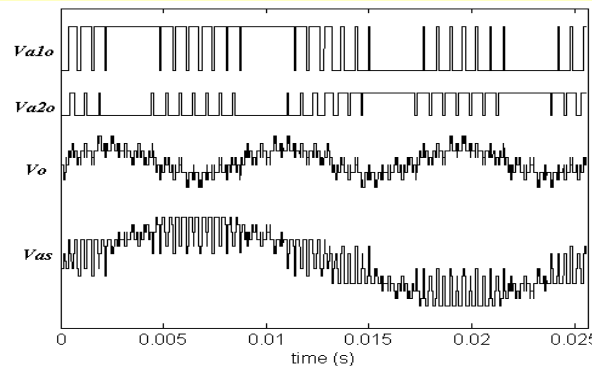
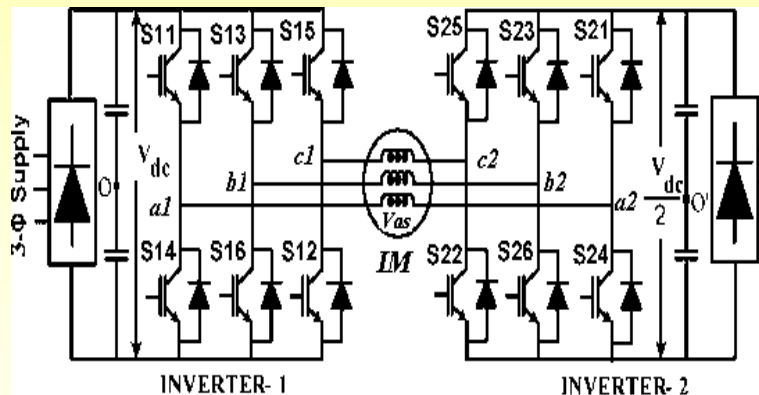
Quarter-wave symmetry of the phase voltage, no even harmonics and sub-harmonics in voltage spectra



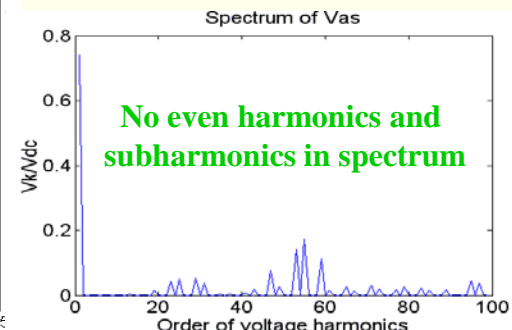
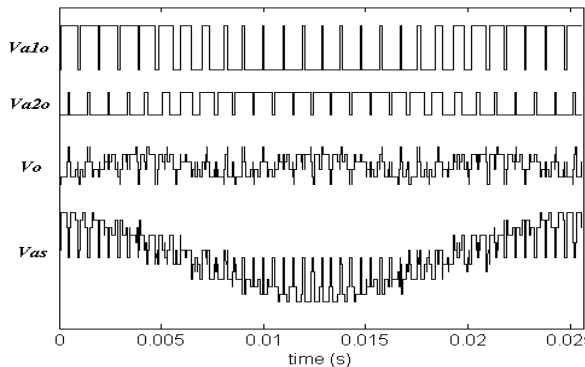
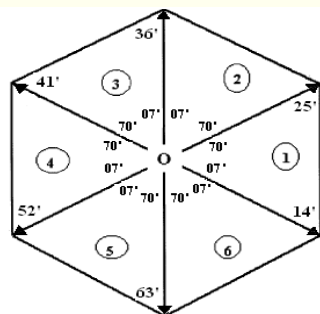
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Technical Report (Quarter 3)

Algorithms of Synchronized Modulation for Control of Asymmetrical Traction Drive with Two DC-Sources



Voltage space-vector combinations, providing avoidance of overcharging of the dc-source capacitors

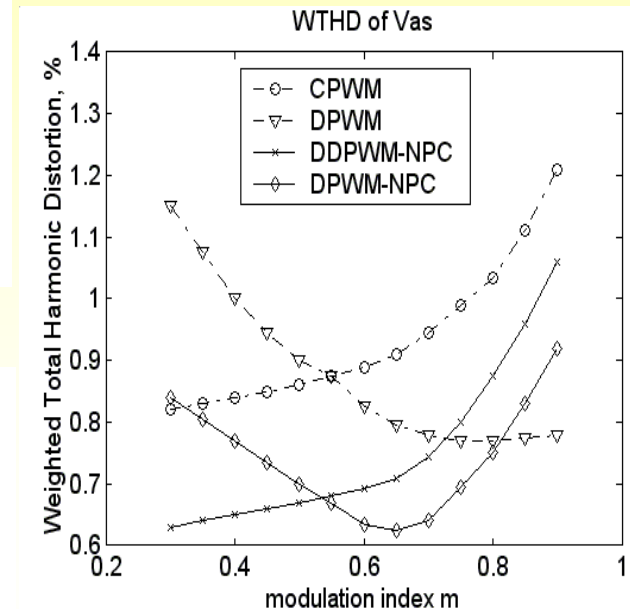
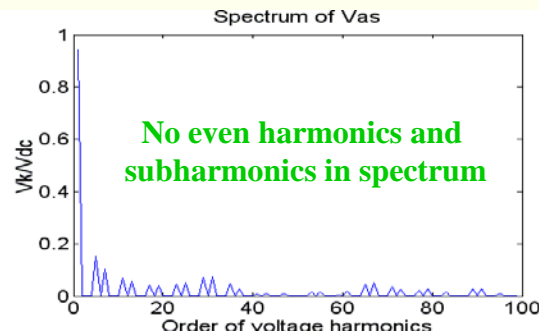
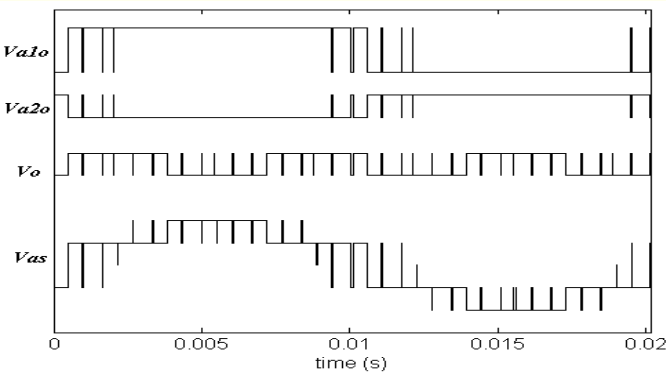
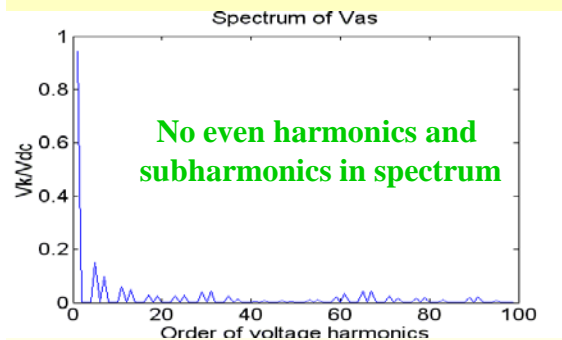
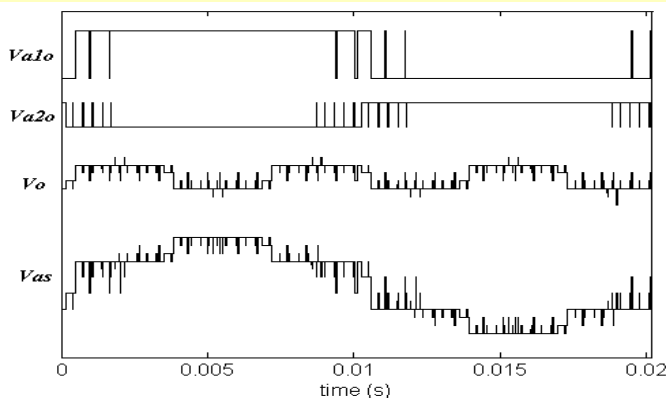


Quarter-wave symmetry of the phase voltages

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Progress Report

Current status of the Project: on schedule

Conference Presentations: Presentation of five reports has been done at four International Conferences:

1. IEEE Int'l Conf. on Intelligent Energy and Power Systems (IEPS'2014, 2-4 June 2014, Kiev, Ukraine);
2. "Problems of the Modern-Day Electrotechniques" (PSE'2014, 4-6 June 2014, Kiev, Ukraine);
3. IEEE Power Electronics and Motion Control Conf. (PEMC'2014, 21-25 September 2014, Antalya, Turkey);
4. IEEE Int'l Conf. on Applied and Theoretical Electricity (ICATE'2014, 21-23 October 2014, Craiova, Romania) – two reports.



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References (12 Publications, including 8 SCOPUS-related publications)

- [1] V. Oleschuk, V. Ermuratskii and V. Berzan, “Multi-Inverter Six-Phase Motor Drive with Two DC Sources and Voltage Waveform Symmetries,” CD-ROM Proc. of the IEEE Development and Application Systems Conf. (DAS’2014), pp. 137-142, 2014.
- [2] V. Oleschuk, V. Ermuratskii and V. Berzan, “Elimination of Subharmonics in Spectra of Output Voltage of Drive Inverters with Space-Vector PWM,” Proc. of the IEEE Int’l Conf. on Harmonics and Quality of Power (ICHQP’2014), pp. 425-430, 2014 (**SCOPUS-related publication**).
- [3] V. Oleschuk and V. Ermuratskii, “Dual-Inverter-Based Photovoltaic System with Discontinuous Synchronized PWM,” Proc. of the IEEE Int’l Conf. on Intelligent Energy and Power Systems (IEPS’2014), pp. 86-89, 2014 (**SCOPUS-related publication**).
- [4] В. Олещук, В. Ермуратский, “Преобразовательная система транспортного электропривода повышенной мощности с алгоритмами синхронной модуляции,” Проблемы региональной энергетики, no. 1, стр. 32-46, 2014.
- [5] V. Oleschuk and V. Ermuratskii, “Dual Inverters with Synchronized Modulation for Transformer-Based Photovoltaic Installations,” Chapter for the “Book on Renewable Energy”, Cambridge Edition, Editor G. Vitale, in press (**SCOPUS-related publication**).
- [6] V. Oleschuk and V. Ermuratskii, “Algorithms of Synchronous Vector Modulation for Hybrid Multi-Converter Six-Phase System,” Proc. of the Int’l Conf. on Microelectronics and Computer Science (ICMCS’2014), pp. 58-63, 2014.
- [7] V. Oleschuk and F. Barrero, “Standard and Non-Standard Approaches for Voltage Synchronization of Drive Inverters with Space-Vector PWM: A Survey,” International Review of Electrical Engineering (IREE), v. 9, no. 4, pp. 688-707, 2014 (**SCOPUS-related publication**).

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References (12 Publications, including 8 SCOPUS-related publications)

- [8] V. Oleschuk, V. Ermuratskii and V. Berzan, “Split-Phase Inverter System with Specific Techniques of Synchronized PWM,” Proc. of the IEEE Int’l Conf. on Applied and Theoretical Electricity (ICATE’2014), 5 p., 2014 (**SCOPUS-related publication**).
- [9] V. Oleschuk, V. Ermuratskii and V. Berzan, “Multilevel Converters and Drives with Space-Vector Modulation and Voltage Waveform Symmetries,” Proc. of the IEEE Int’l Conf. on Applied and Theoretical Electricity (ICATE’2014), 6 p., 2014 (**SCOPUS-related publication**).
- [10] В. Олещук и В. Ермуратский, «Шестифазный асимметричный тяговый электропривод на базе четырех инверторов с синхронной векторной модуляцией», Труды Института энергетики Академии наук Молдовы, 2014.
- [11] V. Oleschuk and V. Ermuratskii, “Combined Topology of Quad-Inverter Six-Phase Motor Drive with Synchronized WM,” Proc. of the IEEE Power Electronics and Motion Control Conf. (PEMC’2014), pp. 1159-1165, 2014 (**SCOPUS-related publication**).
- [12] V. Oleschuk, V. Ermuratskii and F. Barrero, “Modified Algorithms of Synchronized PWM for Six-Phase Traction Drive with Two DC Sources,” Proc. of the IEEE Vehicle Power and Propulsion Conf. (VPPC’2014), 6 p., 2014 (**SCOPUS-related publication**).

Thank you for your attention!

Mulumesc pentru atentie!