

STCU

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

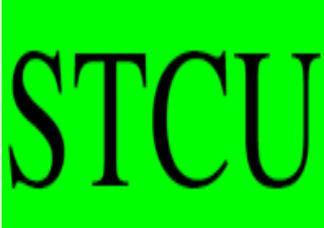
15 December, 2014



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. (Habilitation) 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%



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

Work Schedule for the First Year of the Project

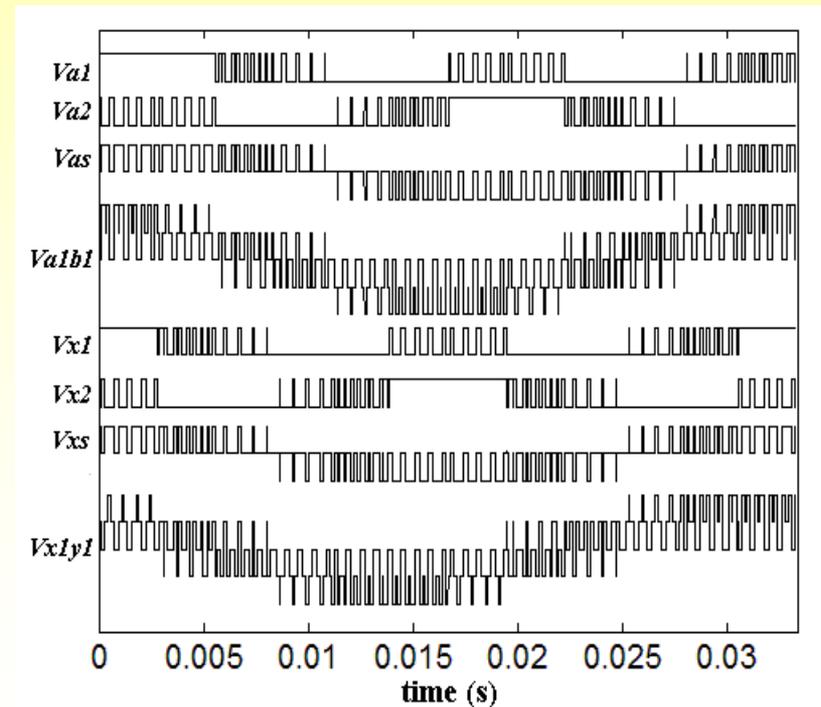
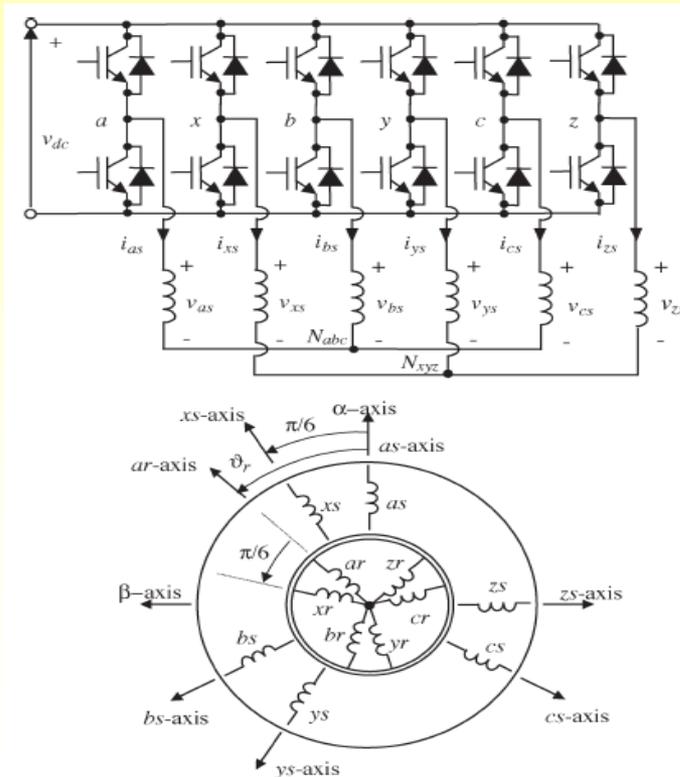
I. Elaboration of schemes and algorithms of synchronized modulation for control of power conversion systems for electric vehicles (March 2014 – February 2015):

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)

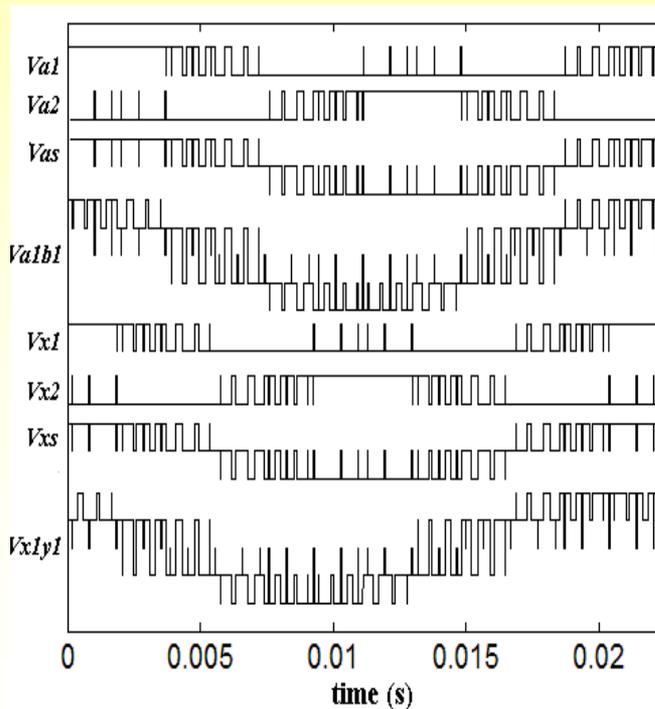
Dual Three-Phase Traction Drive Controlled by Algorithms of Synchronized Pulsewidth Modulation



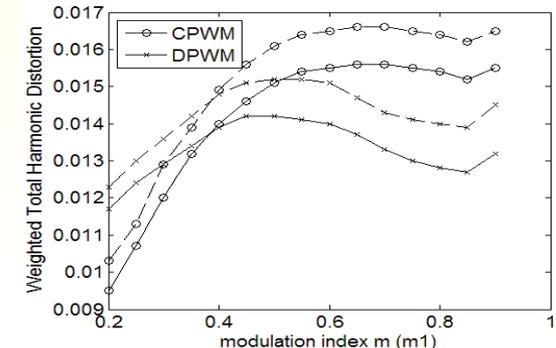
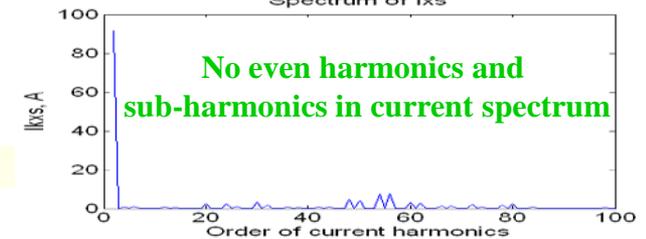
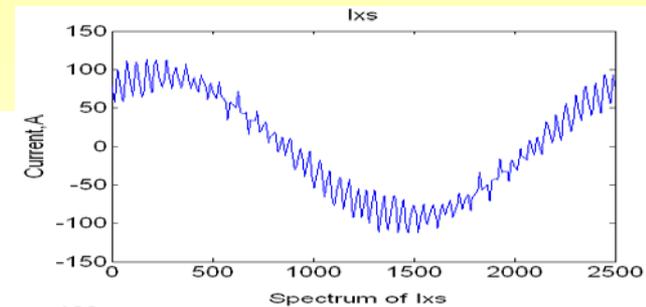
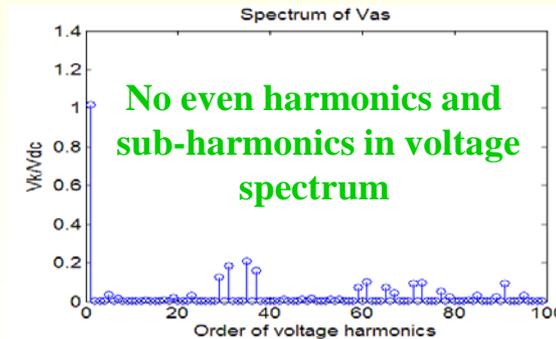
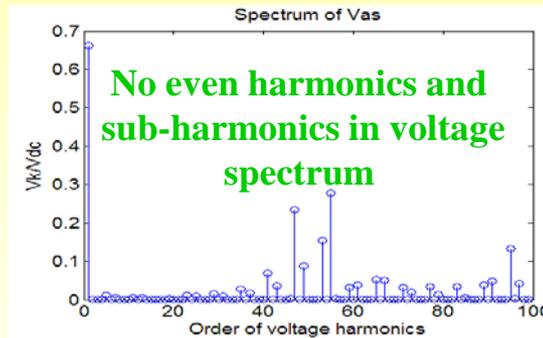
Quarter-wave symmetry of the phase voltage

Technical Report (Quarter 1)

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



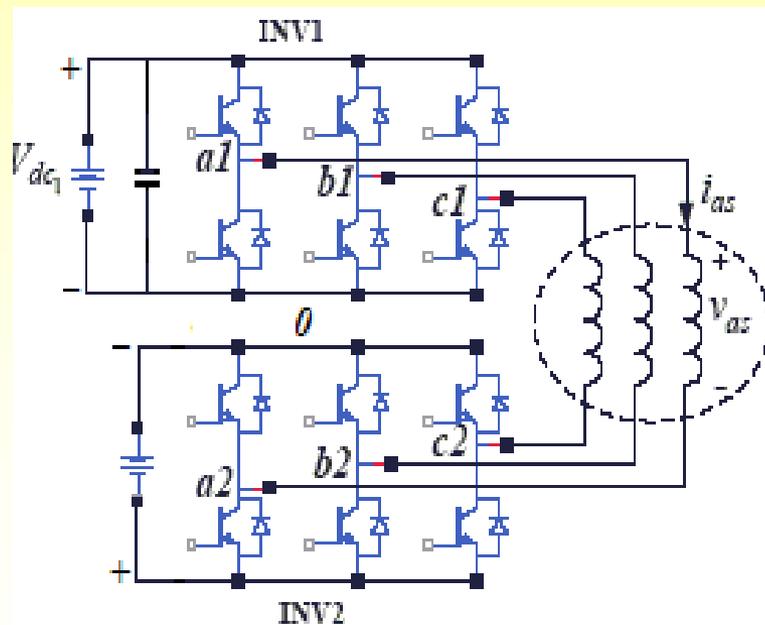
Quarter-wave symmetry of the phase voltage



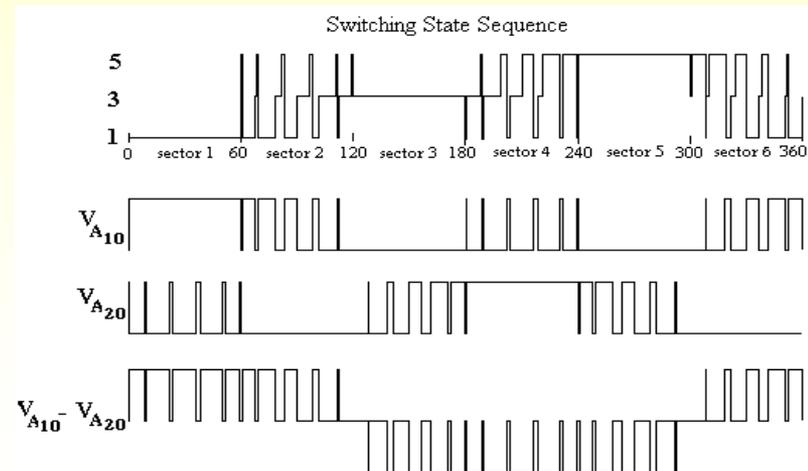
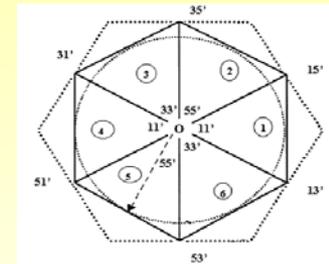
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Technical Report (Quarter 2)

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

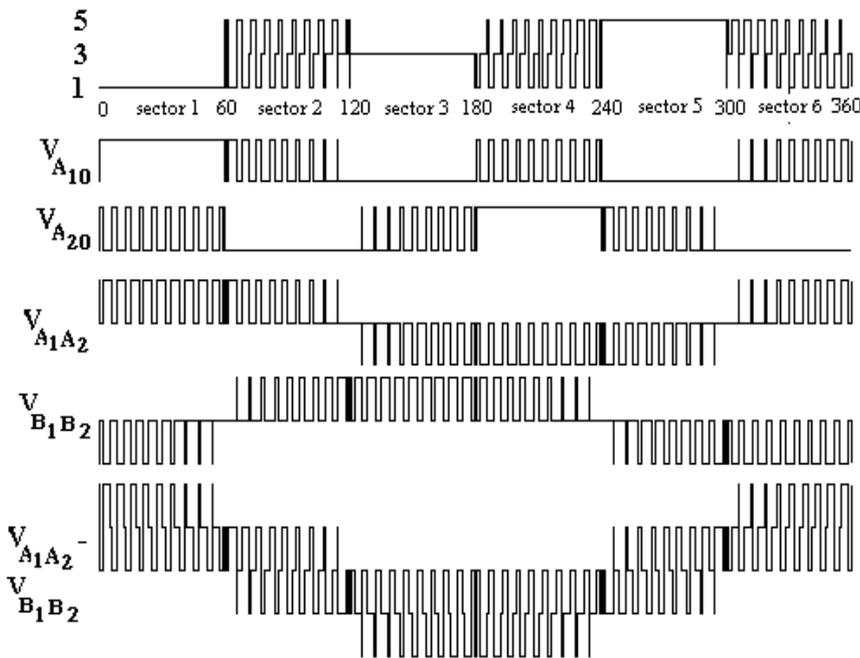


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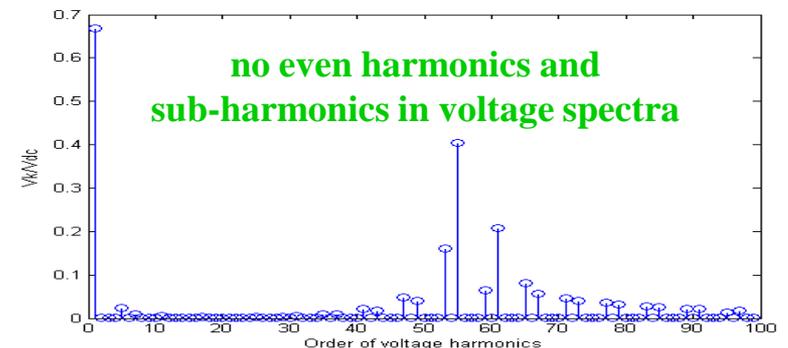
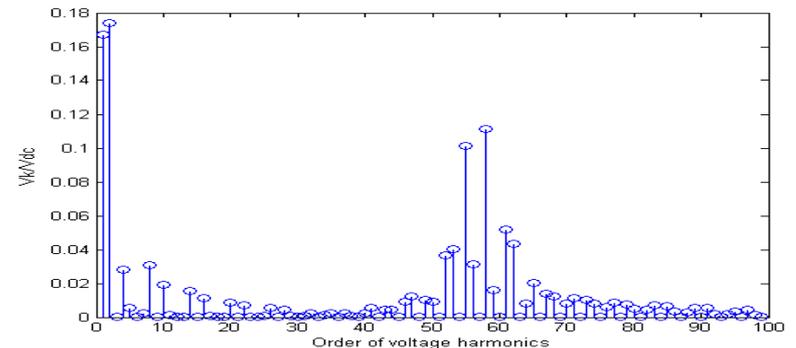
Technical Report (Quarter 2)

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

Switching State Sequence



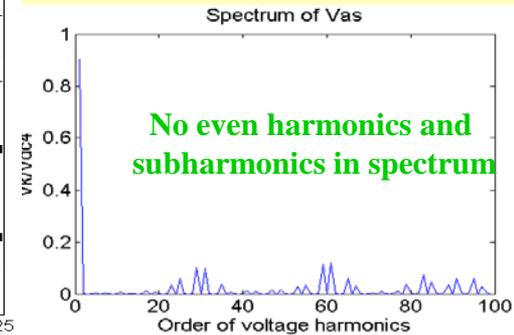
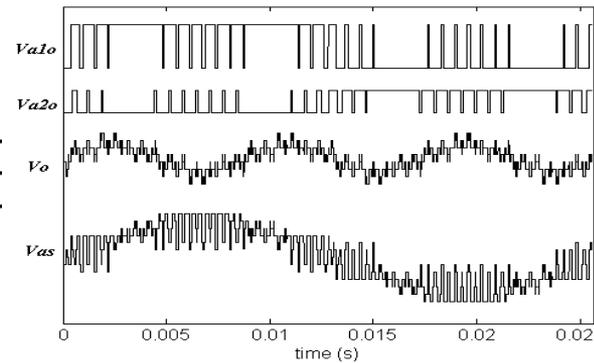
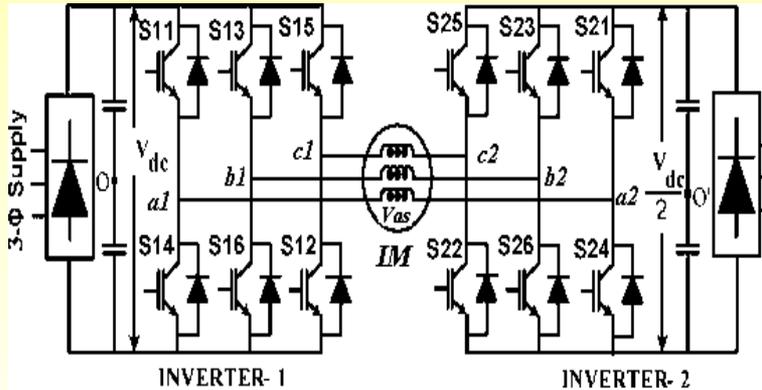
Quarter-wave symmetry of the phase voltage, no even harmonics and sub-harmonics in voltage spectra



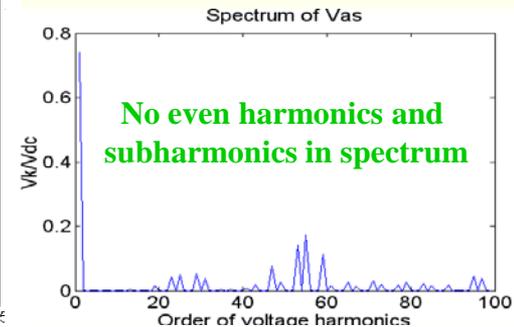
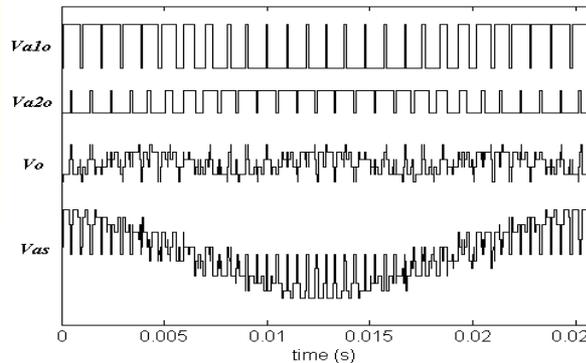
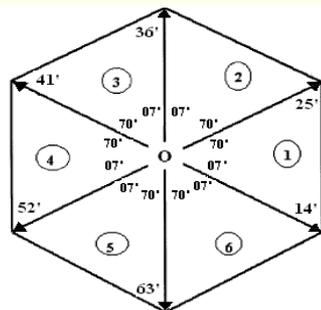
Project 5842: Power Electronic Converters with Synchronized Modulation for Electric Vehicles and for Photovoltaic Systems

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

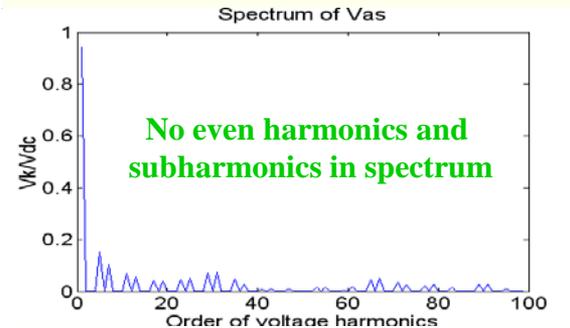
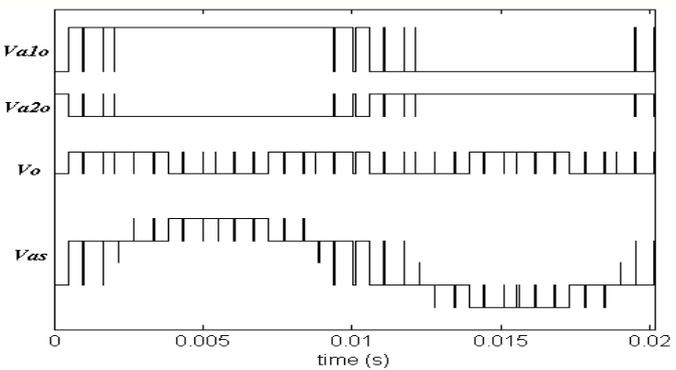
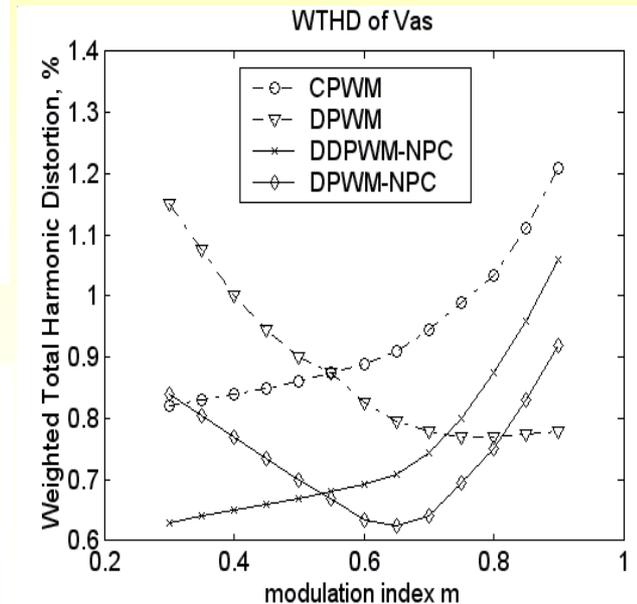
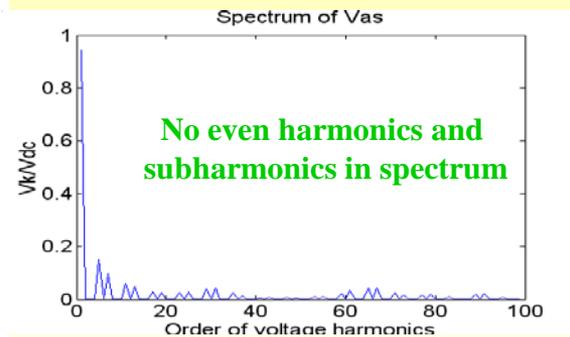
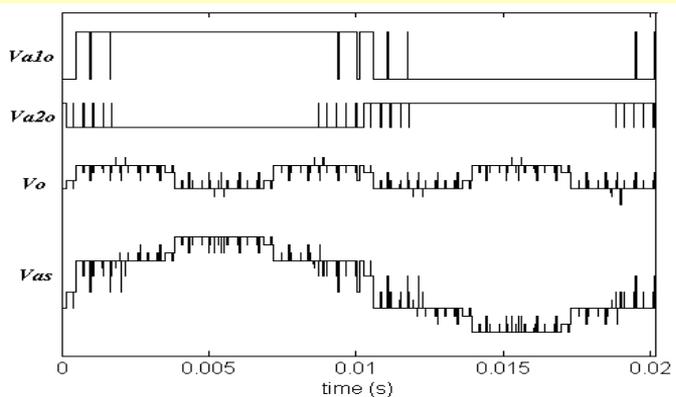


Quarter-wave symmetry of the phase voltages

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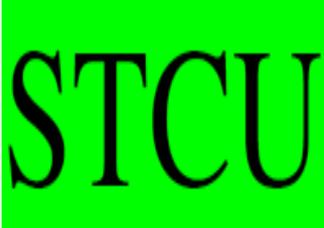
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Progress Report

Current status of the Project: on schedule

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

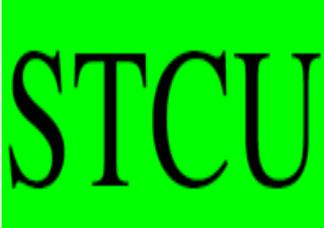
1. IEEE Int'l Conf. on Intelligent Energy and Power Systems (IEPS'2014, 2-4 June 2014, Kiev, Ukraine);
2. "Problems of the Modern-Day Electrotechniques" (PSE'2014, 4-6 June 2014, Kiev, Ukraine);
3. IEEE Power Electronics and Motion Control Conf. (PEMC'2014, 21-25 September 2014, Antalya, Turkey);
4. 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**).

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Thank you for your attention!

Mulumesc pentru atentie!