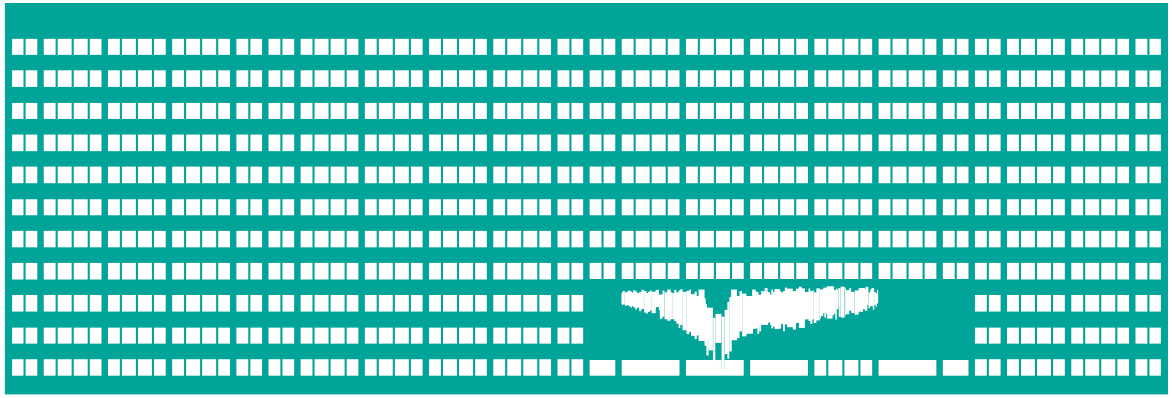
VŠB TECHNICKÁ UNIVERZITA OSTRAVA

VSB TECHNICAL UNIVERSITY OF OSTRAVA



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VSB TECHNICAL UNIVERSITY OF OSTRAVA | FACULTY OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE | DEPARTMENT OF ELECTRONICS

R&D Activities

Research Group:
Power semiconductor systems, Automotive electronics and diagnostics

Jan Strossa

Assistant Professor

R&D Activities

Research Group: Power semiconductor systems, Automotive electronics and diagnostics

Leader:	Associated Professor Petr Simonik, Ph.D.
Academic staff members:	Tomas Pavelek, Ph.D., Jan Strossa, Ph.D., Tomas Mrovec, Ph.D., Vladislav Damec, Ph.D., Martin Sobek, Ph.D., Ales Havel, Ph.D. Tomas Klein, Ph.D, Tomas Harach, Ph.D.
Ph.D. students:	Petr Cyprich, Pavel Cyprich, Petr Krupa

Main R&D topics:

- Development and implementation of modern power semiconductor converters with utilization of new switching principles and optimization of control algorithms
- Optimization of control and improving the quality of electrical energy with utilization of semiconductor converters
- Design and dimensioning of semiconductor converters for energy accumulation systems
- Research and development in the field of automotive electronics and vehicle diagnostics

R&D Activities
Research Group: Power semiconductor systems, Automotive electronics and diagnostics

- **Design of modern topologies of power semiconductor converters**
  - Indirect AC link Frequency Converter
  - Optimization of resonant converter for coupling DC sources
- **Design and manufacture of electric accumulation systems**
  - Reversible voltage inverter for an accumulation unit
  - Power Converters for Coupling different battery technologies (Lead-acid vs LiFePO4)
- **Design, modeling and simulation of power semiconductor converters**
  - 3D CAD Autodesk Inventor
  - OrCAD Pspice
  - Autodesk Eagle / SketchUP
  - Matlab Simulink
  - Ansoft Maxwell
- **Design and testing of complex microcomputer control systems**
  - TMS320F28335 control system
  - NXP Kinetis MKV58FX control system
- **HW and SW development for microcomputer control systems using DSC, MCU**
  - Vector control of current in the voltage source rectifier (pulse rectifier) including SDFT
  - Software PLL unit
- **Development, modification and diagnostics of defects of modern ECUs for cars**

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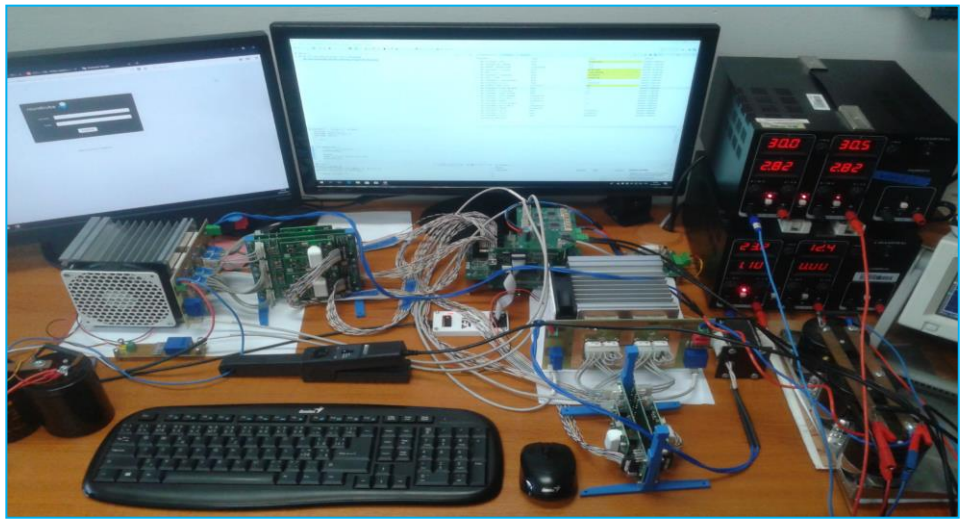
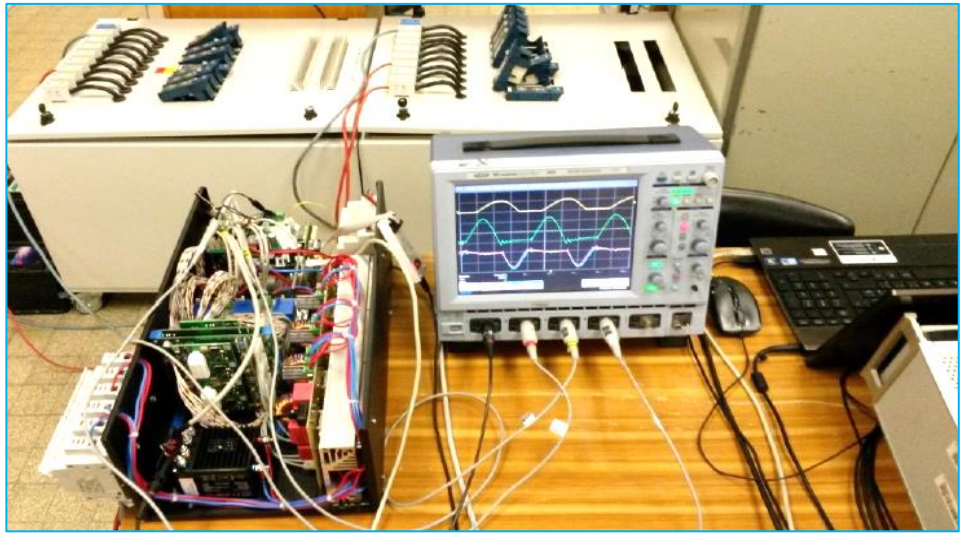
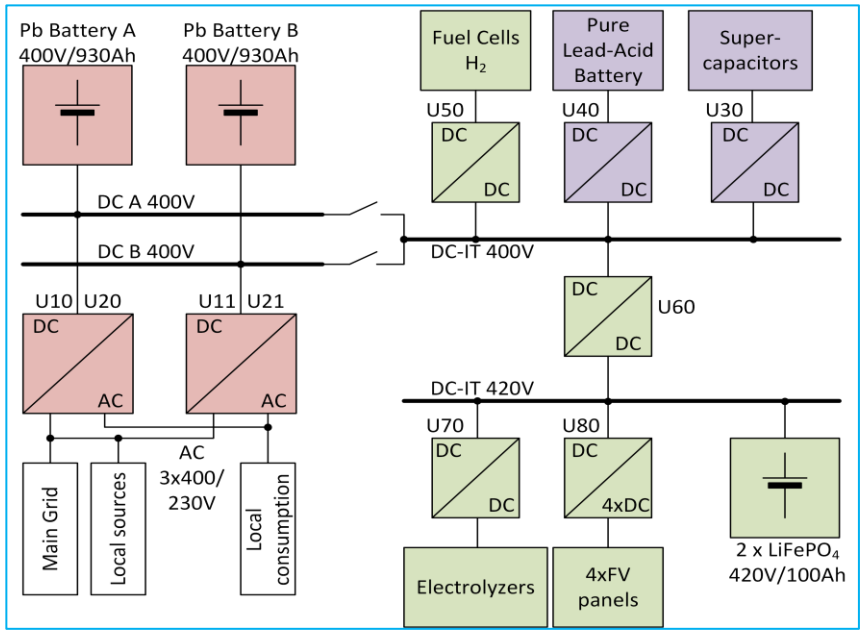
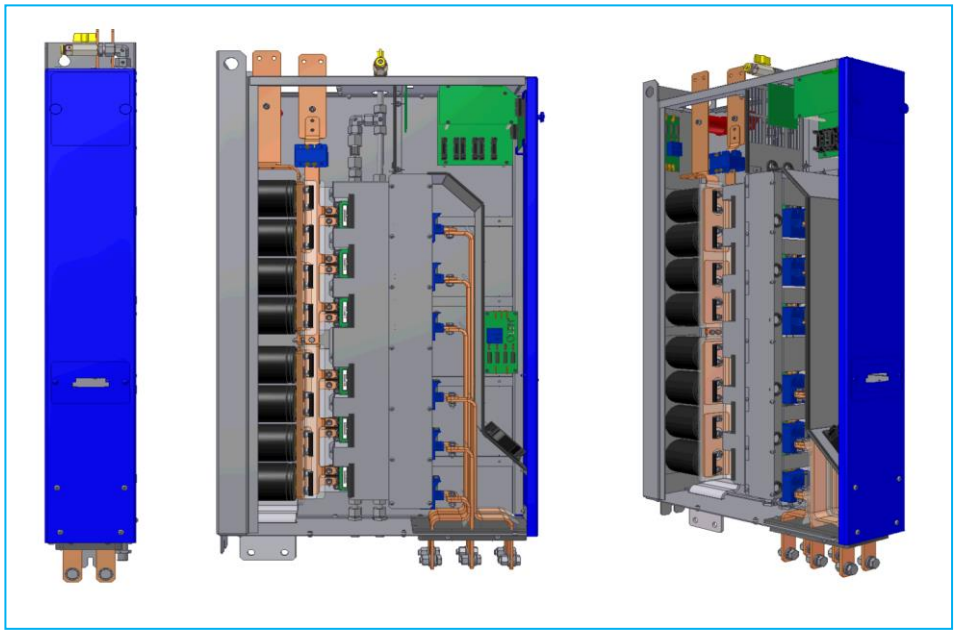
R&D Activities: Indirect AC link Frequency Converter, Optimization of resonant converter for coupling DC sources - Laboratory stands and manufactured prototypes

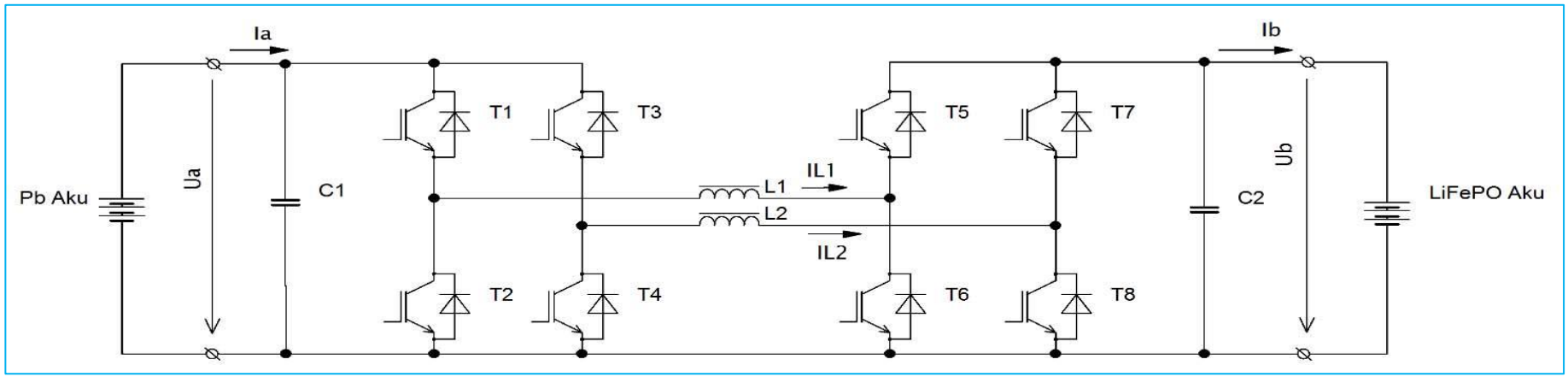




R&D Activities: Reversible voltage inverter for an accumulation unit, Power Converters for Coupling different battery technologies (Lead-acid vs LiFePO4)







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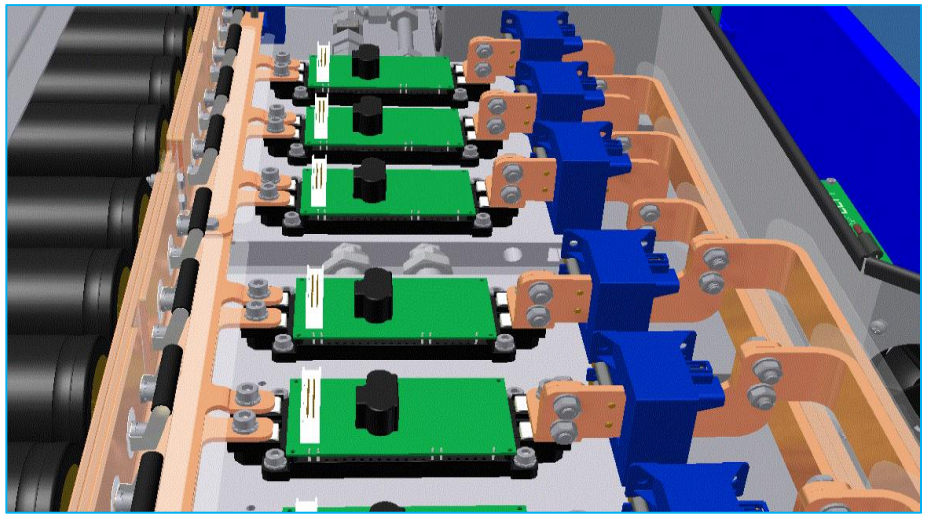
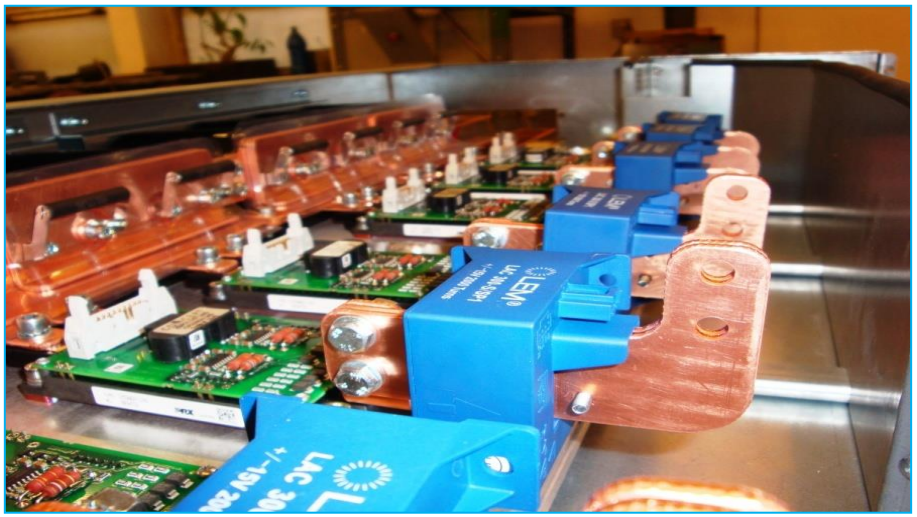
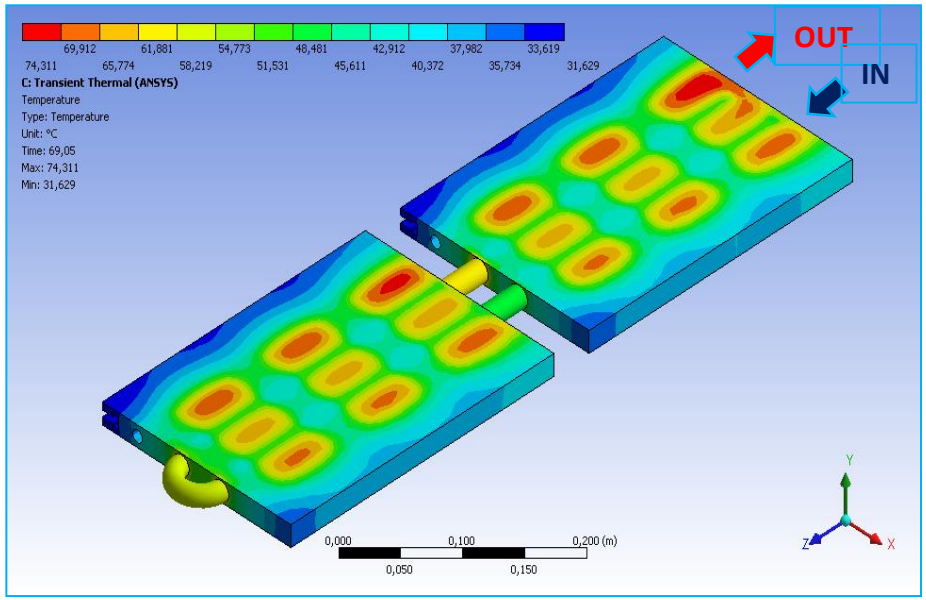
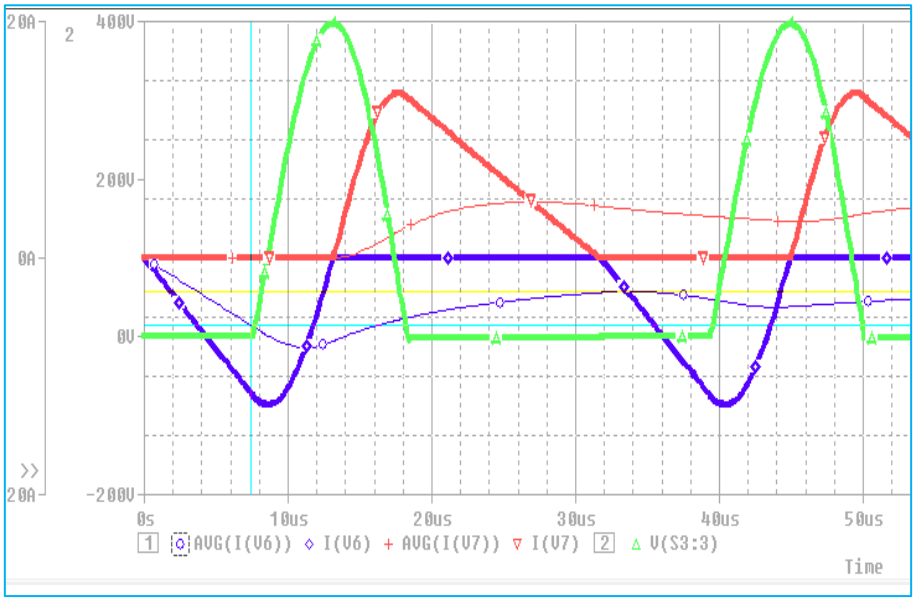
R&D Activities: Design, modeling and simulation of power semiconductor converters



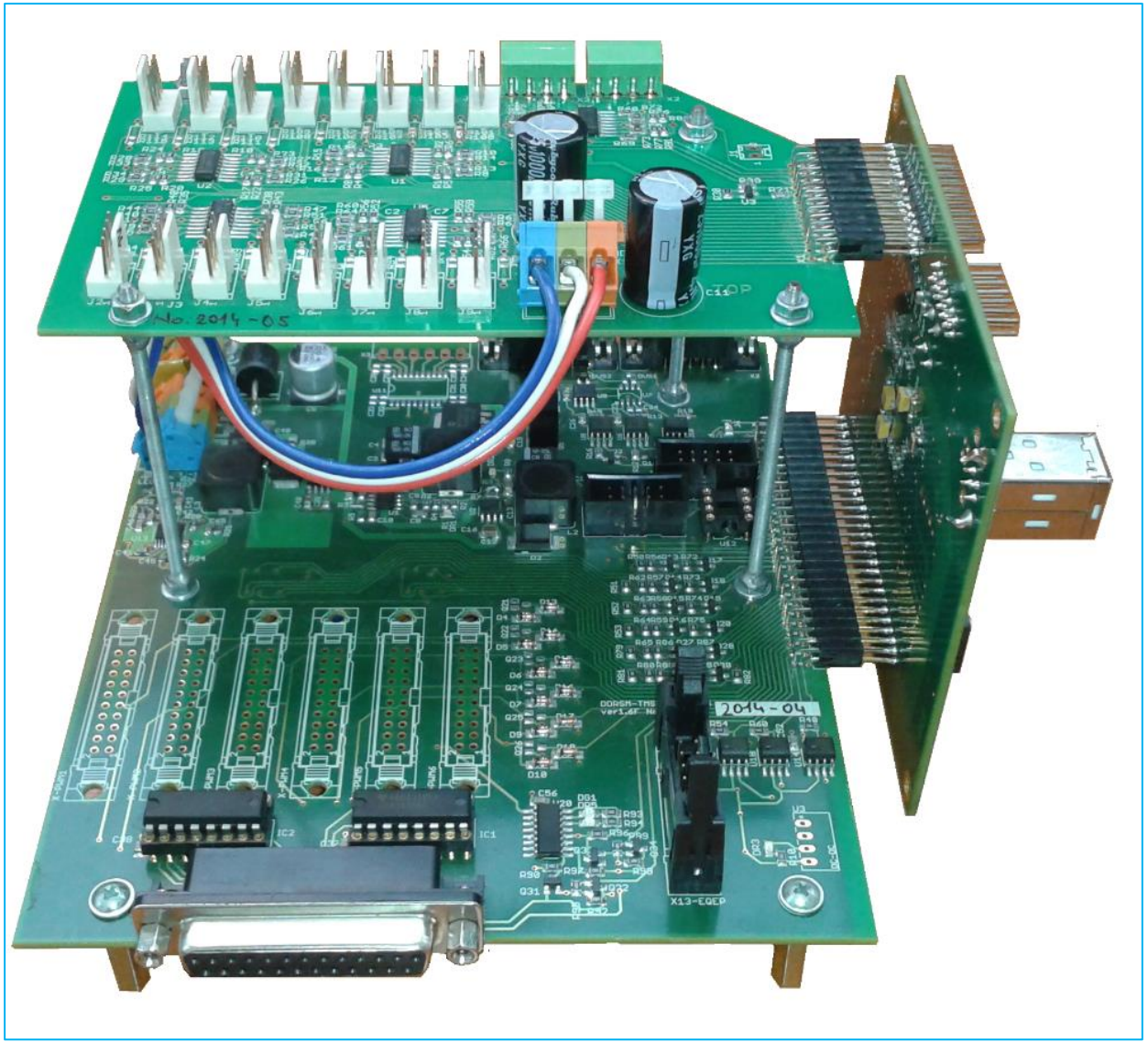






R&D Activities: Designed control system with TMS320F28335

- operating frequency 150MHz
- theoretical time for one instruction 6,67 ns
- floating point (Float format in 32-bit expression)
- 16 analog inputs, 12 bit resolution
- 4 analog outputs, 12 bit resolution
- 6 outputs for connection of power drivers including own power supply
- total 12PWM outputs
- synchronization of PWMs between the converters
- temperature measurement of power modules and the coolant flow through the heat sink
- interfaces: PC - USB, RS422 / 485 - superior system
- possibility of adding a Profibus communication module



R&D Activities: Power semiconductor systems, Automotive electronics and diagnostics
Important projects

- LTE220001 – E Town
- TACR TE02000103 – Centre for Intelligent Drives and Advanced Machines Control (CIDAM), Centre of Competence, 2014-2019
- SP2019/117 – Research and development of electronic systems for vehicles with autonomous control III, 2019
- SP2018/167 - Research and development of electronic systems for vehicles with autonomous control II, 2018
- SP2016/156 – Bidirectional semiconductor converters with transformer for coupling AC/DC and DC/DC systems, 2016
- SP2015/174 – Development of modern semiconductor converters for parallel coupling of DC accumulation systems, 2015
- CZ.1.05/1.1.00/02.0070 – IT4Innovations Centre of Excellence, Research Programme VP5, R&D for Innovations Operational Programme, 2011-2014

An overview of the department's projects can be found at the following link:

https://www.fei.vsb.cz/430/en/research/projects/

R&D Activities: LTE220001 – Modular wide output voltage range e-vehicles charger

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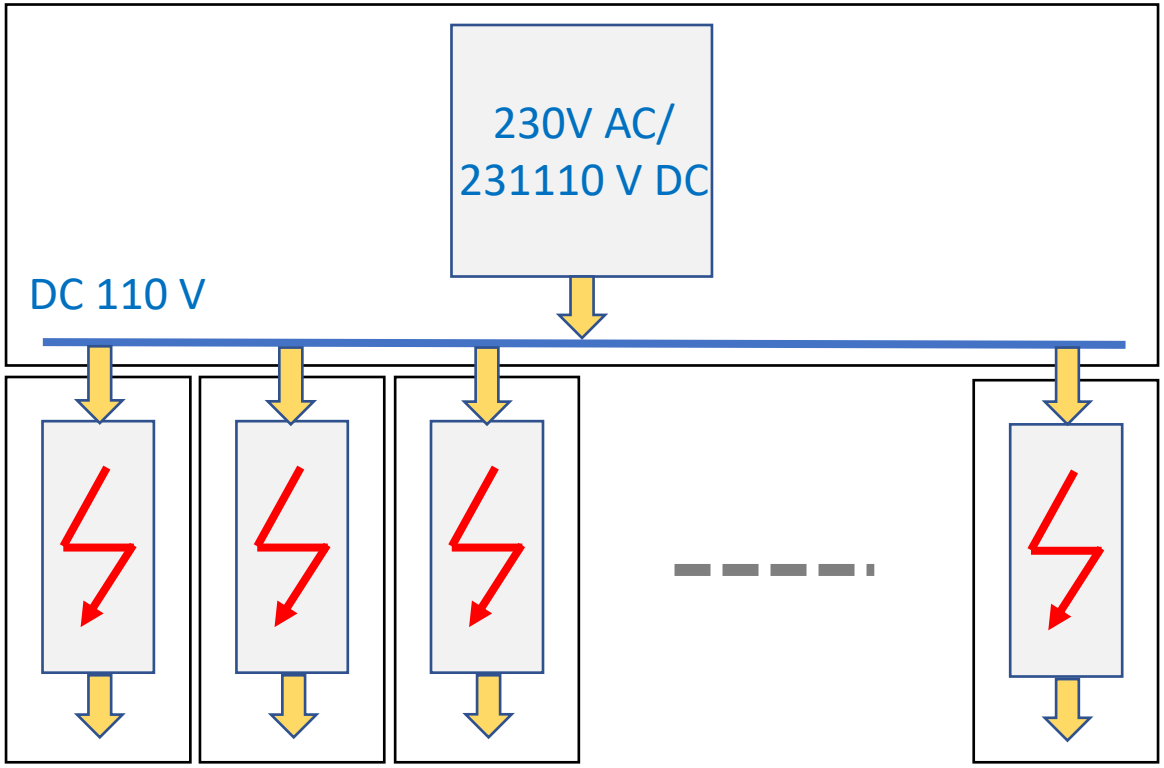
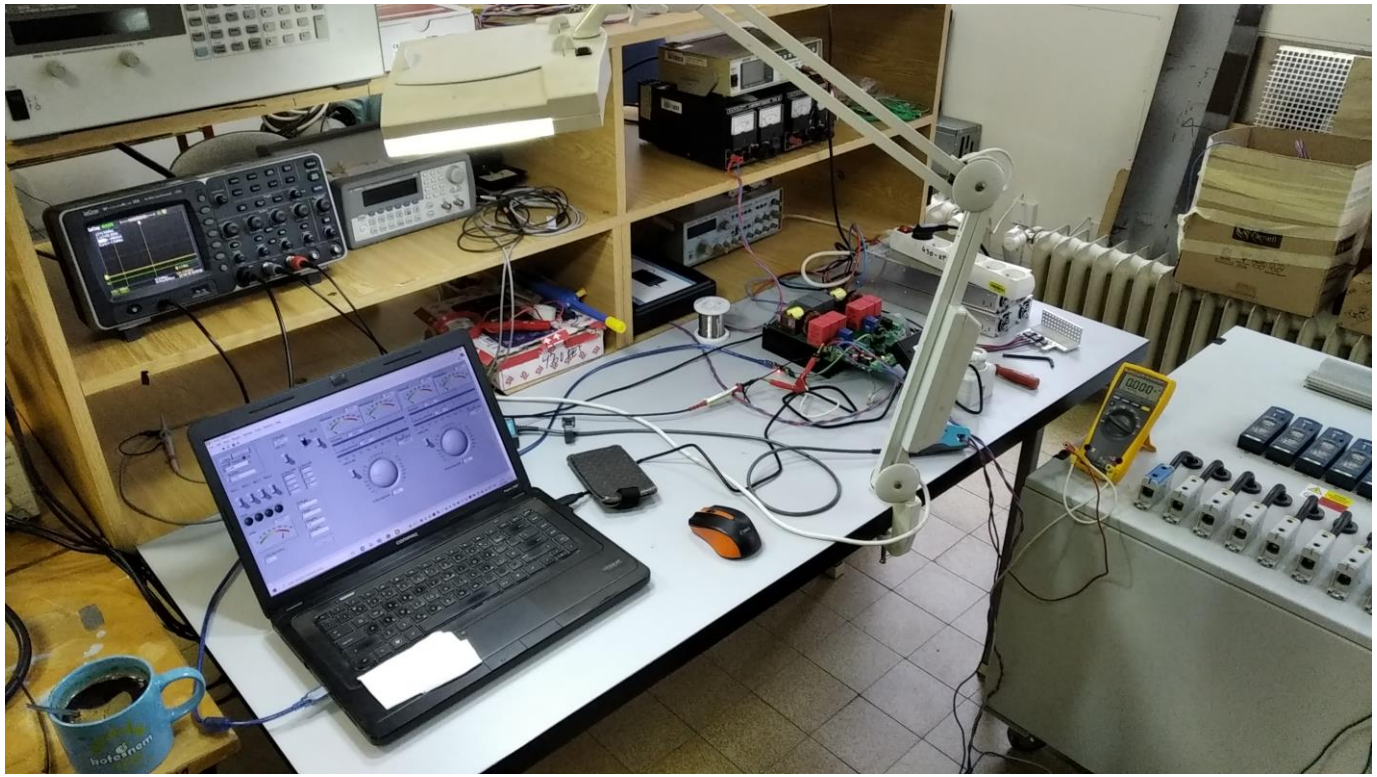
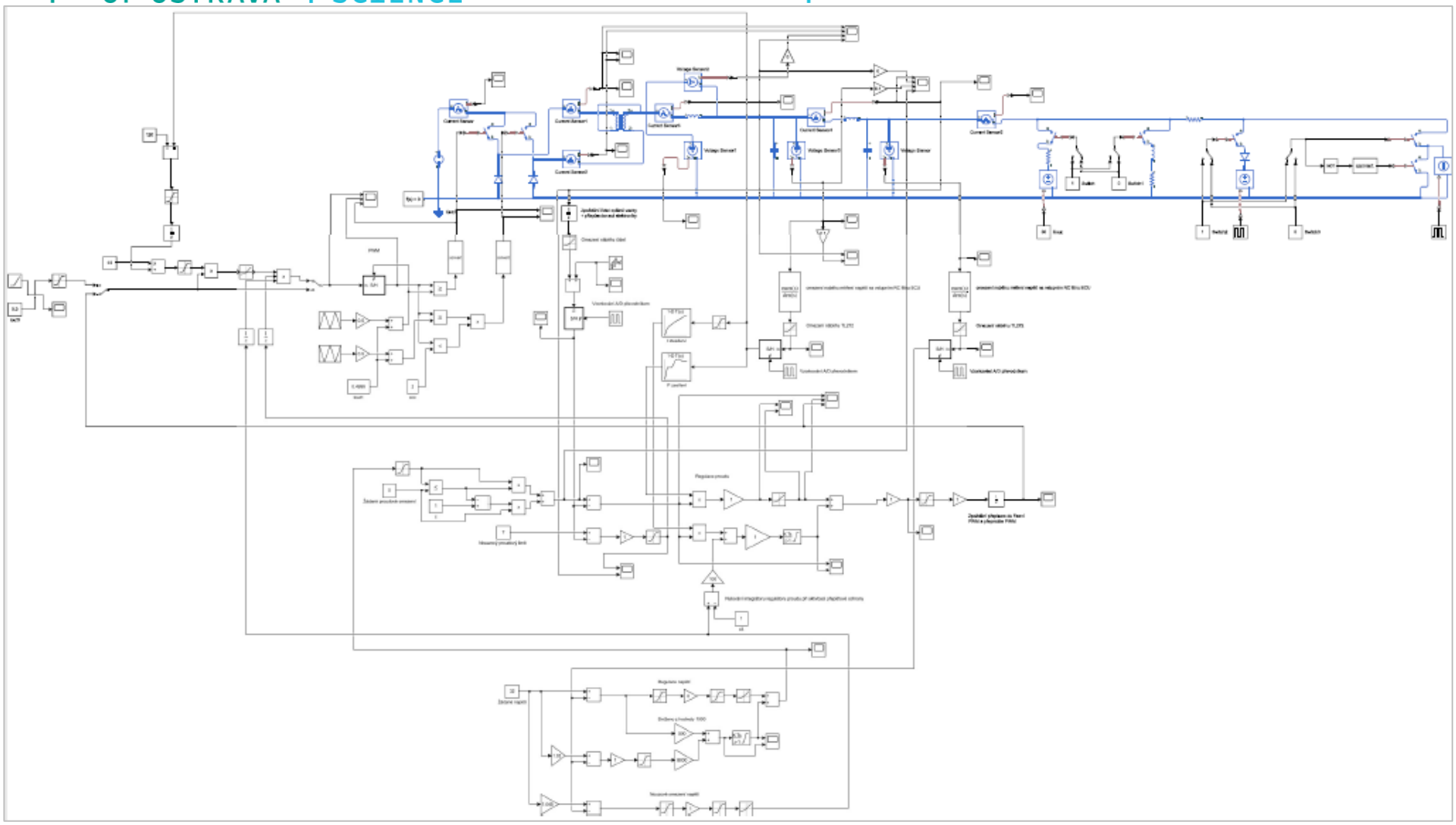
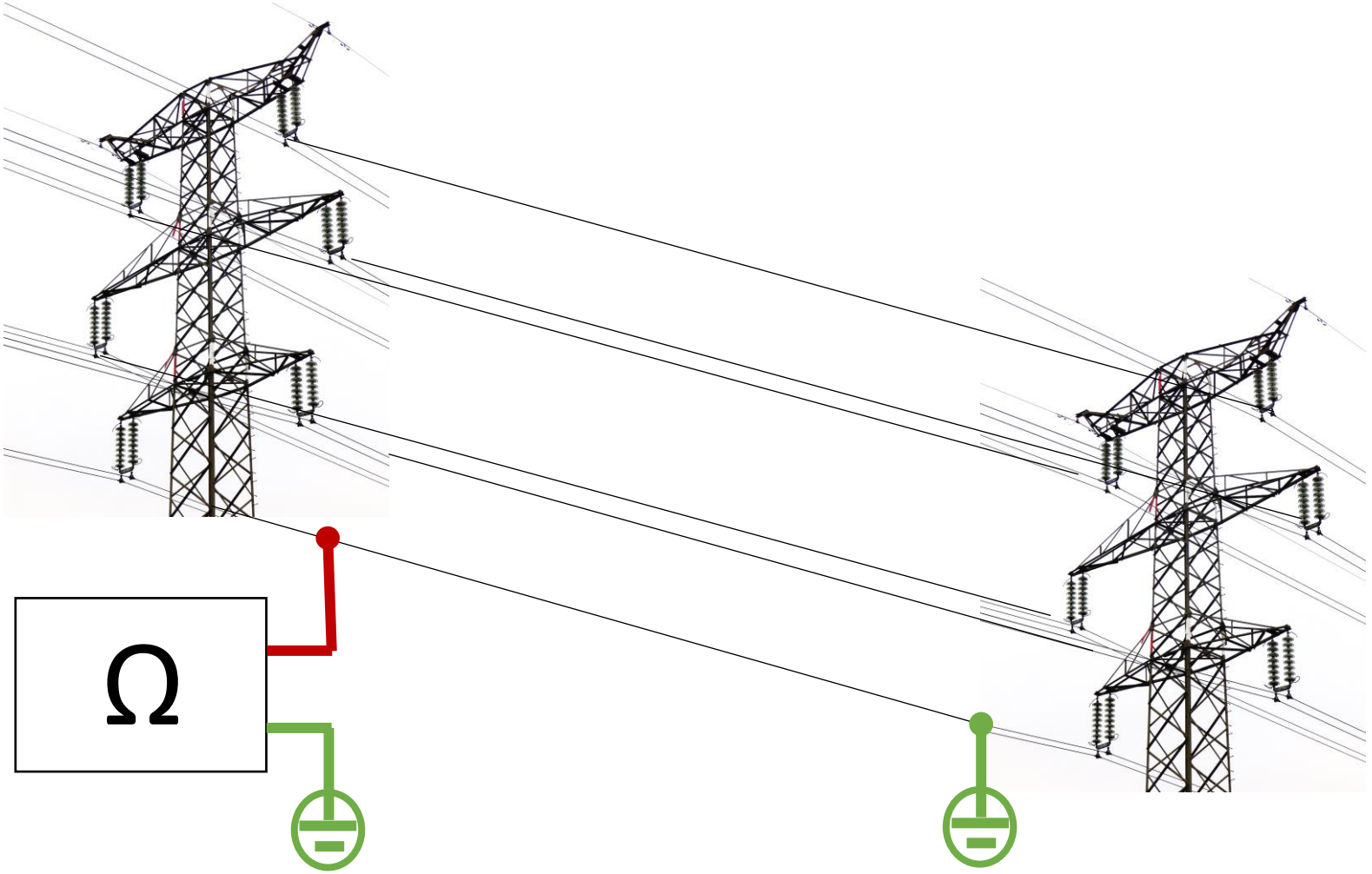


R&D Activities: LTE220001 – Modular wide output voltage range e-vehicles charger

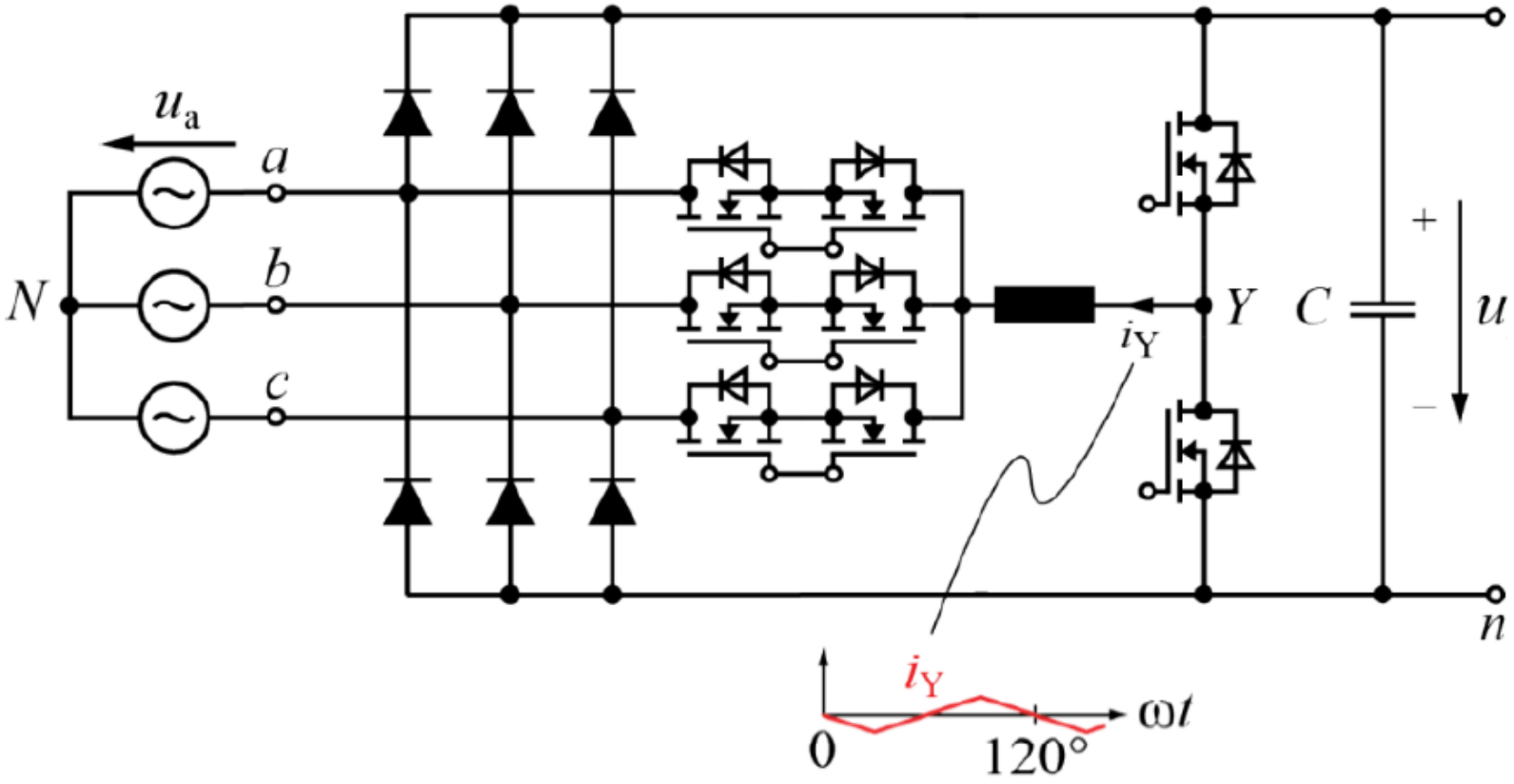




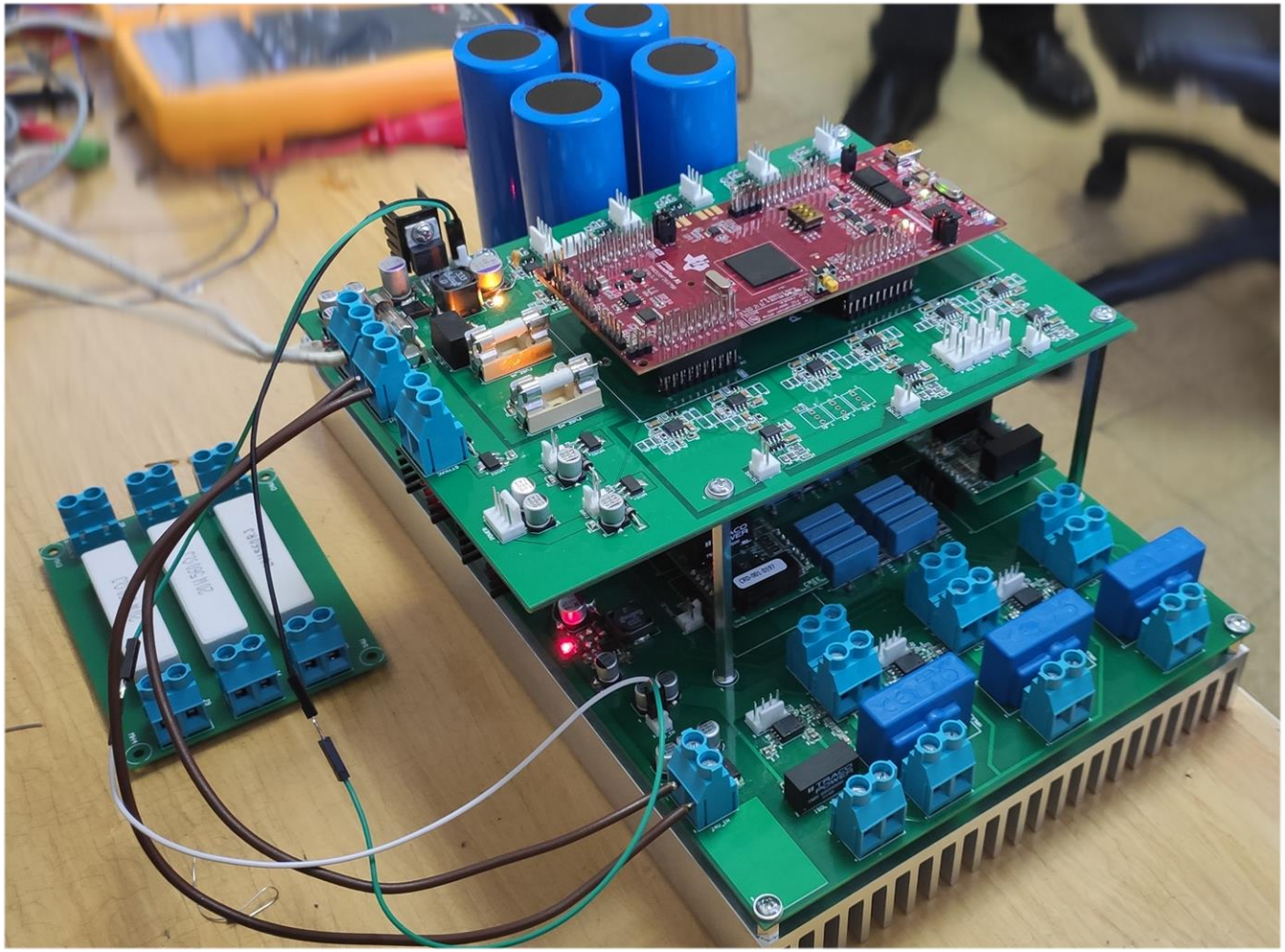
R&D Activities: High voltage grids grounding resistivity measure equipment



R&D Activities: Creating the environment for the vienna rectifier new switching techniques research



R&D Activities: Creating the environment for the vienna rectifier new switching techniques research



R&D Activities: Power semiconductor systems, Automotive electronics and diagnostics
Important publications

- STROSSA, Jan, Vladislav DAMEC, Martin SOBEK, Daniel KOUŘIL and Jakub BAČA. High Frequency Multipurpose SiC MOSFET Driver. Advances in Electrical and Electronic Engineering. Springer 2021, 19(3), pp. 203–21.
- HAVEL, Aleš, Martin SOBEK and Petr PALACKÝ. The measuring and control center for accumulation systems of electrical energy. Electrical Engineering. Springer, 2017, 99(4), p. 1295-1303. ISSN 0948-7921.
- ŠIMONÍK, Petr, Tomáš MROVĚC and Samuel PRZECZEK. Electronic differentials with active torque distribution for IWD vehicles. In: Advances in Intelligent Systems and Computing. Volume 680. Cham: Springer, 2017. p. 428-438. ISBN 978-3-319-68323-2.
- HAVEL, Aleš, Martin SOBEK and Petr CHAMRÁD. Control Methods of Modern Systems Utilizing Accumulation of Electrical Energy. In: EPE 2017 : proceedings of the 18th international scientific conference on electric power engineering : May 17-19, 2017, Kouty nad Desnou, Czech Republic. Piscataway: IEEE, 2017. p. 161-166. ISBN 978-1-5090-6406-9.
- HAVEL, Aleš, Martin SOBEK and Petr CHAMRÁD. Power converters for coupling hydrogen-based technologies with lead-acid and LiFePO4 batteries. In: EPE 2017 : proceedings of the 18th international scientific conference on electric power engineering : May 17-19, 2017, Kouty nad Desnou, Czech Republic. Piscataway: IEEE, 2017. p. 441-444. ISBN 978-1-5090-6406-9.
- CHLEBIŠ, Petr, Martin TVRDOŇ, Kateřina BAREŠOVÁ and Aleš HAVEL. The system of fast charging station for electric vehicles with minimal impact on the electrical grid. Advances in Electrical and Electronic Engineering. Ostrava: VŠB - Technical University of Ostrava, 2016, 14(2), p. 89-94. ISSN 1336-1376.
- PALACKÝ, Petr, Kateřina BAREŠOVÁ, Martin SOBEK and Aleš HAVEL. The control system of electrical energy accumulation. In: ELEKTRO 2016 - 11th International Conference, Proceedings. New York: IEEE, 2016. p. 346-349. ISBN 978-1-4673-8698-2.
- MROVĚC, Tomáš, Petr ŠIMONÍK, Jiří TAKÁČ and Lukáš CÁB. Structure of electronic systems of remotely navigated vehicle. In: Electrical systems for aircraft, railway, ship propulsion and road vehicles & international transportation electrification ESARS-ITEC : proceedings : November 2-4, 2016, Toulouse, France. Vienna: IEEE, 2016. p. 1-6. ISBN 978-1-5090-0814-8.

Thank you for your attention

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