Bartłomiej Ufnalski
Name and surname of the applicant

THE LIST OF PUBLISHED SCIENTIFIC PAPERS AND INFORMATION
ON TEACHING EXPERIENCE, SCIENTIFIC COOPERATION, AND
SCIENCE COMMUNICATION
(after receiving the Ph.D. degree)

I. List of publications constituting the academic achievement

A. Title of the academic achievement: "Application of computational intelligence techniques in power electronics and drives with a particular emphasis on repetitive process control".

B. Publications constituting the academic achievement:

1. Bartłomiej Ufnalski, Arkadiusz Kaszewski, Lech M. Grzesiak, "Particle swarm optimization of the multioscillatory LQR for a three-phase four-wire voltage-source inverter with an LC output filter", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS 62(1), pp. 484–493, 2015, DOI: 10.1109/TIE.2014.2334669, **IF 6.498**.
I was the leading author for this project. My contribution to this paper was to formulate the problem, survey the literature on the multiresonant (a.k.a. multi-oscillatory) controllers for power converters, develop the optimal tuning method for the multiresonant controller, create and develop software tools aimed at supporting the design process by automatizing it almost completely, provide an interpretation of the results, and to prepare the bulk of figures and all of the text, as well as to compose the final manuscript. My estimate for the percentage of my contribution is **55%**.

2. Bartłomiej Ufnalski, Lech M. Grzesiak, Krzysztof Gałkowski, "Particle swarm optimization of an iterative learning controller for the single-phase inverter with sinusoidal output voltage waveform", BULLETIN OF THE POLISH ACADEMY OF SCIENCES – TECHNICAL SCIENCES 61(3), pp. 649–660, 2013, DOI: 10.2478/bpasts-2013-0069, **IF 1.000**.
I was the leading author for this project. My contribution to this paper was to formulate the problem, develop the optimal tuning method for the iterative learning controller, create and develop software tools aimed at supporting the design process by automatizing it almost completely, plan, prepare and perform numerical experiments, provide an interpretation of the results, and to prepare all the figures and all of the text, as well as to typeset the final manuscript. My estimate for the percentage of my contribution is **80%**.

3. Bartłomiej Ufnalski, Lech M. Grzesiak, "Particle swarm optimization of artificial-neural-network-based on-line trained speed controller for battery electric vehicle", BULLETIN OF THE POLISH ACADEMY OF SCIENCES – TECHNICAL SCIENCES 60(3), pp. 661–667, 2012, DOI: 10.2478/v10175-012-0059-9, **IF 0.980**.
I was the leading author for this project. My contribution to this paper was to formulate the problem, develop the optimal tuning method for the speed neurocontroller, create and develop software tools aimed at supporting the design process, as well as to plan, prepare

*and perform numerical experiments, and to prepare all the figures and the bulk of the text. I also composed the final manuscript. My estimate for the percentage of my contribution is **60%**.*

4. Bartłomiej Ufnalski, Lech M. Grzesiak, "Artificial neural network based voltage controller for the single phase true sine wave inverter – a repetitive control approach", PRZEGLĄD ELEKTROTECHNICZNY 89(4), pp. 14–18, 2013, URL: pe.org.pl/articles/2013/4/3.pdf.
*I was the leading author for this project. I invented a neurocontroller with a global update rule applicable in repetitive control systems. My contribution to this paper was to demonstrate numerically the feasibility of my invention. I planned, prepared and performed numerical experiments. I also typeset the final manuscript. My estimate for the percentage of my contribution is **90%**.*

5. Bartłomiej Ufnalski, Lech M. Grzesiak, "A plug-in direct particle swarm repetitive controller for a single-phase inverter", PRZEGLĄD ELEKTROTECHNICZNY 89(6), pp. 6–11, 2014, URL: pe.org.pl/articles/2014/6/2.pdf.
*I was the leading author for this project. I invented a stochastic swarm controller with a global update rule suitable for both repetitive continuous and batch processes. My contribution to this paper was to demonstrate numerically the feasibility of my invention. I planned, prepared and performed experiments. I also typeset the final manuscript. My estimate for the percentage of my contribution is **85%**.*

6. Bartłomiej Ufnalski, Lech M. Grzesiak, "Particle swarm optimization of an online trained repetitive neurocontroller for the sine-wave inverter", The 39th IECON annual conference of the IEEE Industrial Electronics Society, pp. 6001-6007, 2013, DOI: 10.1109/IECON .2013.6700120.
*I was the leading author for this project. My contribution to this paper was to develop the optimal tuning method for the previously invented repetitive neurocontroller that includes simultaneous parameter and structure optimization. I planned, prepared and performed experiments. I also composed the camera-ready manuscript and presented it at the conference. My estimate for the percentage of my contribution is **85%**.*

7. Bartłomiej Ufnalski, Lech M. Grzesiak, "A performance study on synchronous and asynchronous update rules for a plug-in direct particle swarm repetitive controller", ARCHIVES OF ELECTRICAL ENGINEERING 63(4), pp. 635–646, 2014, DOI: 10.2478/aee-2014-0044.
*I was the leading author for this project. My contribution to this paper was to propose replacing a synchronous update rule in the previously invented direct particle swarm repetitive controller with an asynchronous one. I planned, prepared and carried out numerical experiments, as well as provided a discussion on the benefits resulting from this transition. I composed the manuscript. My estimate for the percentage of my contribution is **90%**.*

8. Bartłomiej Ufnalski, Lech M. Grzesiak, "A comparative investigation on different randomness schemes in the particle-swarm-based repetitive controller for the sine-wave inverter", Advances in Intelligent Systems and Computing, 323, pp. 165–176, Springer 2014, ISSN 2194-5357, DOI: 10.1007/978-3-319-11310-4_15.
I was the leading author for this project. My contribution to this paper was to propose, inter alia, replacing the online pseudorandom number generation in the previously invented direct particle swarm repetitive controller with a list-based generator. I planned, prepared and conducted numerical experiments, as well as provided a discussion on the

benefits resulting from this transition. I composed the manuscript. My estimate for the percentage of my contribution is 90%.

9. Bartłomiej Ufnalski, Lech M. Grzesiak, "Repetitive neurocontroller with disturbance feedforward path active in the pass-to-pass direction for a VSI inverter with an output *LC* filter", BULLETIN OF THE POLISH ACADEMY OF SCIENCES – TECHNICAL SCIENCES 64(1), pp. 115–125, 2016, DOI: 10.1515/bpasts-2016-0013, **IF 0.914** (as of 2014).
I was the leading author for this project. Essentially my contribution was to introduce the repetitive disturbance feedforward in the pass-to-pass direction at inputs of the invented neurocontroller. I prepared a numerical model and performed experiments to demonstrate a significant improvement in the disturbance rejection. I coined the phrase 'disturbance dual feedforward' and created the manuscript. My estimate for the percentage of my contribution is 90%.

10. Bartłomiej Ufnalski, Lech M. Grzesiak, "Plug-in direct particle swarm repetitive controller with a reduced dimensionality of a fitness landscape — a multi-swarm approach", BULLETIN OF THE POLISH ACADEMY OF SCIENCES – TECHNICAL SCIENCES 63(4), pp. 857–866, 2015, DOI: 10.1515/bpasts-2015-0098, **IF 0.914** (as of 2014).
I was the leading author for this project. Above all my contribution to this paper was to divide the dynamic optimization problem at hand into several or even dozens of separate swarms to simplify the shape of a cost function and in turn to increase the convergence rate. I coined the phrase 'multi-swarm repetitive controller' and prepared the manuscript. My estimate for the percentage of my contribution is 90%.

II. List of other (not being a part of the academic achievement of part I) published research papers and indicators of scientific achievements

A. Publications in journals from the Journal Citation Reports (JCR):
All the below papers have been published as a result of research endeavours in which I was engaged as a principal investigator or one of the main co-investigators. Above all my contribution to these papers was to formulate or co-formulate the problem, develop or co-develop control algorithm and numerical models, to assist in performing experiments and provide or participate in the interpretation of the results. I was also in charge of the manuscripts' multiple revisions. My estimates for the percentage of my contribution to the specific papers are given below each item.

1. Grzegorz Gąbka, Arkadiusz Kaszewski, Bartłomiej Ufnalski, Lech Grzesiak, Paweł Roszczyk, "Series plug-in hybrid powertrain system – an experimental setup", Przegląd Elektrotechniczny 88(4b), pp. 300-303, 2012, **IF 0.244** as of 2011, in 2012 still in WoS and on the A list.
My estimate for the percentage of my contribution is 20%.

2. Lech Grzesiak, Arkadiusz Kaszewski, Paweł Roszczyk, Grzegorz Gąbka, Bartłomiej Ufnalski, "Power management in series hybrid drive", Przegląd Elektrotechniczny 88(4b), pp. 304-308, 2012, **IF 0.244** as of 2011, in 2012 still in WoS and on the A list.
My estimate for the percentage of my contribution is 20%.

3. Bartłomiej Ufnalski, Lech Grzesiak, Grzegorz Gąbka, "Magistrala CAN w sprzężeniu zwrotnym układu regulacji prędkości dla pojazdu elektrycznego – badania techniką HIL",

Przegląd Elektrotechniczny 88(11a), pp. 1–7, 2012, **IF 0.244** as of 2011, in 2012 still in WoS and on the A list.
My estimate for the percentage of my contribution is 40%.

4. Bartłomiej Ufnalski, Lech Grzesiak, Marek Michalczuk, "A lithium battery and ultracapacitor hybrid energy source for an urban electric vehicle", Przegląd Elektrotechniczny 88(4b), pp. 158–162, 2012, **IF 0.244** as of 2011, in 2012 still in WoS and on the A list.
My estimate for the percentage of my contribution is 35%.

5. Bartłomiej Ufnalski, Marek Michalczuk, Lech Grzesiak, "Hybridization of the lithium energy storage for an urban electric vehicle", Bulletin of the Polish Academy of Sciences – Technical Sciences 61(2), pp. 325-333, 2013, **IF 1.000**.
My estimate for the percentage of my contribution is 45%.

6. Marek Michalczuk, Bartłomiej Ufnalski, Lech M. Grzesiak, "Fuzzy logic based power management strategy using topographic data for an electric vehicle with a battery- ultracapacitor energy storage", COMPEL: The International Journal for Computation and Mathematics in Electrical and Electronic Engineering, 34, pp. 173-188, 2015, **IF 0.371**.
My estimate for the percentage of my contribution is 40%.

B. Innovative design achievements

1. Bartłomiej Ufnalski, Lech Grzesiak, Arkadiusz Kaszewski, Marek Michalczuk, Piotr Rumniak, Andrzej Gałecki, Piotr Biernat, Grzegorz Gąbka: the designing, development, building and putting into operation a power electronic converter drive system for a two-motor zero-emission urban electric vehicle equipped with a hybrid battery–ultracapacitor energy storage. "ECO-Mobility", Warsaw University of Technology, 2013 (an exemplary video clip available at www.eco-mobilnosc.pw.edu.pl). Currently submitted to the Prime Minister's Award for outstanding scientific achievement.
I was the leader for the subtask within the task "ECO-Car". My estimate for the percentage of my contribution is 30%.

2. Bartłomiej Ufnalski, Piotr Biernat, Lech Grzesiak: the designing, development, building and putting into operation a power electronic converter equipped with the stochastic swarm repetitive controller of the output voltage. Warsaw University of Technology, 2014 (described e.g. in [II.N2]).
I invented the stochastic swarm controller with a global update rule suitable for both repetitive continuous and batch processes. I also expanded on the time-distributed PSO calculations to enable the development of an effective code suitable for real-time implementation in a cost-effective fixed-point digital signal controllers such as the Texas Instruments TMS320F2812 DSC. My estimate for the percentage of my contribution is 85%.

3. Bartłomiej Ufnalski, Lech Grzesiak: the developement of an iterative learning neuro-controller equipped with repetitive disturbance feedforward path. Warsaw University of Technology, 2014 (described e.g. in [I.B9, II.N4]).
I invented the neurocontroller with repetitive disturbance feedforward. My estimate for the percentage of my contribution is 90%.

C. Granted patents

1. Method of discontinuous pulse-width modulation for voltage-source multi-leg converter and the modulator to utilize this method (original title: Sposób nieciągłej modulacji szerokości impulsów dla wielogałęziowego przekształtnika napięcia oraz modulator do

stosowania tego sposobu), national patent, Patent Office of the Republic of Poland, P-395453, granted on December 23, 2014.

I contributed to the statement of the problem. I was then involved in the substance of the research effort that led to the development of a novel pulse-with modulation method. The key feature of the invention is that the modulation discontinuity is introduced in a phase that carries the lowest current at a given moment to reduce overall switching losses in a drive or grid-tie converter. I was also in charge of the preparation of the patent application. My share is 25%.

2. Method of discontinuous pulse-width modulation for voltage-source multi-leg converter and the modulator to utilize this method (original title: Sposób nieciągłej modulacji szerokości impulsów dla wielogałęziowego przekształtnika napięcia oraz modulator do stosowania tego sposobu), national patent, Patent Office of the Republic of Poland, P-395452, granted on July 7, 2014.

I contributed to the statement of the problem. I was then involved in the substance of the research effort that led to the development of a novel pulse-with modulation method. The key point of the invention is that the modulation method is universal in terms of the number of converter legs and several known continuous and discontinuous modulation methods for 3-level converters can now be easily implemented also in multi(4 or more)-leg inverters. The distinguishing feature is that the computational complexity of the method does not grow with the number of legs. I was also in charge of the preparation of the patent application. My share is 20%.

D. Monographs and publications in scientific journals that are not included in the JCR list:
   – chapters in monographs of non-post-conference type:

1. Bartłomiej Ufnalski, Lech M. Grzesiak, Arkadiusz Kaszewski, "Advanced control and optimization techniques in AC drives and DC/AC sine wave voltage inverters: selected problems", chapter in "Advanced and Intelligent Control in Power Electronics and Drives", pp. 303–333, Springer 2014, DOI: 10.1007/978-3-319-03401-0_9.

I was the leading author for this project. My contribution to this chapter was to prepare a set of experiments aimed at illustrating that a gradient-free population-based controller synthesis in power electronics and drives is a viable approach and provides effective tuning also for systems that are not manageable using intuitive analytical methods. I prepared the relevant numerical models and carried out experiments to support the point. I composed the bulk of the manuscript. My estimate for the percentage of my contribution is **60%**.

2. Bartłomiej Ufnalski, Lech M. Grzesiak, "Selected methods in flux estimation for induction motor drives", chapter in "Power electronics and electrical drives – selected problems", pages 204–222, Polish Academy of Sciences, Electrical Engineering Committee, 2007.

I was the leading author for this project. My contribution to this chapter was to formulate the problem and to demonstrate the equivalence or ineffectiveness of the selected published flux estimation methods to give researchers a better perspective. I developed a novel flux neuroestimator. I composed the bulk of the manuscript. My estimate for the percentage of my contribution is **50%**.

3. Marek Michalczuk, Bartłomiej Ufnalski, Lech Grzesiak, "Hybrid energy storage for an urban electric passenger car" (original title: "Hybrydowy magazyn energii miejskiego samochodu elektrycznego"), chapter in "Ecomobility – Volume I: Innovative and ecological means of transport" (original title: "Ekomobilność – Tom I: Innowacyjne i ekologiczne środki transportu", pp. 375–394, Wydawnictwa Komunikacji i Łączności, 2015.

I was the leader for the project aimed at developing a powertrain for the ECO-Car. My

*contribution to this chapter was to co-formulate the problem, co-develop the system described in the chapter, and revise the manuscript. My estimate for the percentage of my contribution is **40%**.*

– articles in journals:

1. Bartłomiej Ufnalski, Lech M. Grzesiak, "Feedback and feedforward repetitive control of single-phase UPS inverters – an online particle swarm optimization approach", Scientific Reports of the Cologne University of Applied Sciences, 1, pp. 59–67, 2014, ISSN 1612-9040.
   *I was the leading investigator for this project. I added to the previously invented direct particle swarm repetitive controller a refinement in the form of a disturbance feedforward path that takes into account the repetitiveness of the process being controlled. My contribution to this paper was to formulate the problem, plan, prepare, and perform numerical experiments. I was also in charge of composing the manuscript. My estimate for the percentage of my contribution is **80%**.*

2. Piotr Rumniak, Bartłomiej Ufnalski, Lech Grzesiak, "Tuning of PI regulators in distributed control system for an electric vehicle", Przegląd Elektrotechniczny 91(9), pp. 290–294, 2015.
   *I was the leading author for this project. My contribution to this paper was to formulate the problem, propose the solution, co-develop source codes, and participate in manuscript editing. My estimate for the percentage of my contribution is **40%**.*

3. Lech Grzesiak, Bartłomiej Ufnalski, "Neural-network-based magnetic flux estimator for electric car drive" (original title: "Neuronowy estymator strumienia magnetycznego maszyny napędowej dla samochodu elektrycznego"), Logistyka, 4, pp. 1-12, 2010.
   *I was the principal investigator for the subtask, within the ECO-Mobility project, devoted to the ECO-Car powertrain development. My contribution to this paper was to formulate the problem, propose the solution, co-develop the source codes, perform the comparison and numerical assessment of selected estimation methods. I was engaged in the preparation of the bulk of the final manuscript. My estimate for the percentage of my contribution is **50%**.*

4. Marek Michalczuk, Lech Grzesiak, Bartłomiej Ufnalski, Piotr Rumniak, "Power converter-based electrochemical battery emulator", Przegląd Elektrotechniczny 90(7), pp. 18–22, 2014.
   I am the dissertation auxiliary supervisor for the main author. My contribution to this paper was to co-formulate the problem, co-develop mathematical models and revise the manuscript. My estimate for the percentage of my contribution is 30%.

5. Marek Michalczuk, Piotr Rumniak, Piotr Biernat, Andrzej Gałecki, Lech Grzesiak, Bartłomiej Ufnalski, Arkadiusz Kaszewski, "System sterowania dla przekształtnikowego układu napędowego miejskiego pojazdu elektrycznego z hybrydowym magazynem energii", Napędy i Sterowanie, 4/2014, pp. 117–126, 2014.
   I was the principal investigator for the subtask, within the ECO-Mobility project, devoted to the ECO-Car powertrain development. My contribution to this paper was to formulate the problem and co-develop control algorithms. I was also in charge of co-building a mobile full-size mockup of the ECO-Car. I revised the manuscript. My estimate for the percentage of my contribution is 15%.

6. Lech Grzesiak, Bartłomiej Ufnalski, Arkadiusz Kaszewski, Grzegorz Gąbka, Marek Michalczuk, Andrzej Gałecki, Piotr Biernat, Piotr Rumniak, "An electric vehicle powertrain

with a hybrid battery and ultracapacitor energy storage for urban areas" (original title: "Układ napędowy elektrycznego pojazdu miejskiego z hybrydowym bateryjno-ultrakondensatorowym magazynem energii"), Zeszyty Problemowe — Maszyny Elektryczne 95(2), pp. 13–20, 2012.
I was the principal investigator for the subtask, within the ECO-Mobility project, devoted to the ECO-Car powertrain development. My contribution to this paper was to formulate the problem and co-develop control algorithms. I was also in charge of co-building a scale model of the ECO-Car powertrain – a four-drive test set-up equipped with an auxiliary ultracapacitor storage and a controlled grid converter. I revised the manuscript. My estimate for the percentage of my contribution is 20%.

7. Lech Grzesiak, Bartłomiej Ufnalski, Arkadiusz Kaszewski, Marek Michalczuk, Piotr Rumniak, Andrzej Gałecki, Piotr Biernat, "Power electronic drive system for an urban electric vehicle with a hybrid energy storage – the physical emulator and the mobile mockup", (original title: "Przekształtnikowy układ napędowy dla miejskiego pojazdu elektrycznego z hybrydowym magazynem energii – emulator fizyczny oraz makieta mobilna"), Zeszyty Problemowe – Maszyny Elektryczne 98(1), pp. 79–88, 2013.
I was the principal investigator for the subtask, within the ECO-Mobility project, devoted to the ECO-Car powertrain development. My contribution to this paper was to formulate the problem and co-develop control algorithms. I was also in charge of co-building a mobile full-size mockup of the ECO-Car. I revised the manuscript. My estimate for the percentage of my contribution is 25%.

8. Piotr Biernat, Piotr Rumniak, Marek Michalczuk, Andrzej Gałecki, Lech Grzesiak, Bartłomiej Ufnalski, Arkadiusz Kaszewski, "Powertrain system with the ultracapacitor-based auxiliary energy storage for an urban battery electric vehicle", The Archives of Transport 27–28 (3–4), pp. 45-64, 2013.
I was the principal investigator for the subtask, within the ECO-Mobility project, devoted to the ECO-Car powertrain development. My contribution to this paper was to formulate the problem and co-develop control algorithms. I was also in charge of co-building a mobile full-size mockup of the ECO-Car. I revised the manuscript. My estimate for the percentage of my contribution is 15%.

9. Andrzej Gałecki, Arkadiusz Kaszewski, Lech M. Grzesiak, Bartłomiej Ufnalski, "State-space current controller for the four-leg two-level grid-connected converter", Przegląd Elektrotechniczny 90(11), pp. 63–66, 2014.
I am the dissertation auxiliary supervisor for the main author. My contribution to this paper was to co-formulate the problem, co-develop mathematical models, cross-check the results, and to revise the manuscript. My estimate for the percentage of my contribution is 20%.

10. Andrzej Gałecki, Arkadiusz Kaszewski, Lech M. Grzesiak, Bartłomiej Ufnalski, "Control system of the grid-connected converter based on a state current regulator with oscillatory terms", Przegląd Elektrotechniczny, 91(1), pp. 65–69, 2015.
I am the dissertation auxiliary supervisor for the main author. My contribution to this paper was to co-formulate the problem, co-develop mathematical models, cross-check the results, and to revise the manuscript. My estimate for the percentage of my contribution is 15%.

11. Lech Grzesiak, Vincent Meganck, Jakub Sobolewski, Bartłomiej Ufnalski, "DTC-SVM drive with ANN-based speed controller", Przegląd Elelktrotechniczny 82(2), pp. 118–122, 2006.
I was the leading investigator for this research. My contribution to this paper was to

*formulate the problem, develop the control algorithm, plan experiments and provide an interpretation of the results. I also composed the bulk of the manuscript draft. My estimate for the percentage of my contribution is **40%**.*

E. Documentation of research projects

   1. Documentation of research works within the projects listed in II.L.

   2. Participation in the preparation of partial and final reports for the projects listed in II.L.

   3. Report mentioned in III.J.
   My estimate for the average percentage of my contribution to the preparation of the above-mentioned documentation is 35%.

F. Total Impact Factor According to Journal Citation Reports (JCR): 11.7, or 12.7 if the Electrical Review papers [II.A1–II.A4] are included.

G. Total citations according to Web of Science Core Collection (with/without self-citations): 80/46.

H. Total citations according to Scopus (with/without self-citations): 153/81.

I. Total citations according to Publish or Perish: 226.

J. Hirsch Index according to Web of Science: 4.

K. Hirsch Index according to Scopus: 4.

L. Leadership and participation in international and national scientific and industrial projects:

   1. Research grant of the Polish Research and Development Center (NCBiR, Applied Research Programme PBS III), "Superconducting magnetic energy storage with a power electronic interface for the electric power systems" (original title: "Nadprzewodzący magazyn energii z interfejsem energoelektronicznym do zastosowań w sieciach dystrybucyjnych", acronym: NpME, scheduled for 01.07.2015–30.06.2018, amount of funding: 3 910 000 PLN, own contribution of entrepreneur: 743 598 PLN – as a **manager/leader** (Warsaw University of Technology as a leader).

   2. Research grant of the Polish Research and Development Center (NCBiR, Generator of Ecological Concepts Programme GEKON), "Effective electric energy storage for photovoltaic renewable energy systems and smart grids" (original title: "Efektywny System Magazynowania Energii dla Fotowoltaicznych Systemów OZE i zastosowań w SMART GRID"), acronym: ESME, scheduled for: 01.10.2014–30.07.2016 – as a co-investigator within the contract for research and development signed between the beneficiary (S.A.M. Polska Sp. z o.o.) and the Faculty of Electrical Engineering of the Warsaw University of Technology.

   3. Contract for research and development between the Faculty of Electrical Engineering of the Warsaw University of Technology and HyGen Power (Pty) Ltd [South Africa] to perform the work entitled "Power electronics converter for variable speed generator", scheduled for: 21.07.2015–31.12.2016 – as a co-investigator.

   4. European Funds – The Innovative Economy Operational Programme WND-POIG.01.03 .01-14-154/09, duration: 2009–2013, acronym: "ECO-Mobilność" ("ECO-Mobility") – as a **manager/leader for the subtask** related to the designing, development, building and putting into operation a power electronic converter drive system for a two-motor

zero-emission urban electric vehicle equipped with a hybrid battery–ultracapacitor energy storage, the subtask within the task "ECO-Samochód" ("ECO-Car"), also as a co-investigator for this subtask.

5. Research Grant No. NN511352537 of the Polish Ministry of Science and Higher Education, duration: 01.10.2009–01.09.2012, "Electric energy source with a variable-speed internal combustion engine, ultracapacitor energy storage and back-to-back converters" (original title: "Źródło energii elektrycznej z silnikiem spalinowym o regulowanej prędkości, superkondensatorowym magazynem energii i układem przekształtników złożonych" – as a co-investigator.

6. Research work for the Faculty of Automotive and Construction Machinery Engineering of the Warsaw University of Technology (SiMR PW), "Developement of theory fundamentals of designing power electronic converter systems for hybrid vehicle powertrains under the domestic conditions" (original title: "Opracowanie podstaw teorii projektowania systemów energoelektronicznych w napędach hybrydowych pojazdów w warunkach krajowych"), 2009 – as a co-investigator.

7. Research work for Ship Design and Research Centre (Centrum Techniki Okrętowej S.A. Zakład Badawczo-Rozwojowy w Gdańsku), "Modern towing carriages for ship model basins" (original title: "Nowoczesne pomosty okrętowych modelowych basenów holowniczych", 2009 – as a co-investigator.

8. Research grant No. 3T10A02728 of the Committee for Research Projects (KBN), duration: 01.06.2005–31.05.2007, "Application of artificial neural networks to adaptive control in a speed-sensorless induction motor drive" (original title: "Zastosowanie sztucznych sieci neuronowych do sterowania adaptacyjnego w bezczujnikowym napędzie z silnikiem klatkowym" – as a co-investigator.

M. International and national awards for scientific activities:

1. WUT Rector's Award 3rd Class for team scientific achievements (my share: 50%) within the field of optimal control for repetitive processes (October 2015).

2. WUT Rector's Award 2nd Class for individual scientific achievements (October 2006).

N. Papers presented at national and international scientific conferences:
All the below papers have been published as a result of research endeavours in which I was engaged as a principal investigator or one of the main co-investigators. Above all my contribution to these papers was to formulate or co-formulate the problem, develop or co-develop control algorithm and numerical models, to assist in performing experiments and provide or participate in the interpretation of the results. I was also in charge of the manuscripts' multiple revisions and in many instances I was the speaker at the conferences. My estimates for the percentage of my contribution to the specific papers and my role in delivering the presentation are given below each item. In the case of papers devoted to the repetitive neurocontroller or the repetitive swarm controller I invented, I was the leading author.

1. Marek Michalczuk, Lech Grzesiak, Bartłomiej Ufnalski, "Experimental parameter identification of battery-ultracapacitor energy storage system", IEEE 24th International Symposium on Industrial Electronics (ISIE), pp. 1337–1341, 2015.
*I designed the identification tool. My estimate for the percentage of my contribution is **40%**.*

2. Piotr Biernat, Bartłomiej Ufnalski, Lech Grzesiak, "Real-time implementation of the multi-swarm repetitive control algorithm", 9th International Conference on Compatibility

and Power Electronics (CPE), pp. 119–125, 2015.
*I designed the time-distributed swarm calculations. My estimate for the percentage of my contribution is **45%**. I prepared and delivered a **lecture**-style presentation.*

3. Andrzej Gałecki, Arkadiusz Kaszewski, Bartłomiej Ufnalski, Lech Grzesiak, "LQ current control for three-phase PWM rectifiers under unbalanced grid voltage conditions", 9th International Conference on Compatibility and Power Electronics (CPE), pp. 191–196, 2015.
My estimate for the percentage of my contribution is 20%.

4. Bartłomiej Ufnalski, Lech Grzesiak, "Repetitive neurocontroller with disturbance dual feedforward – choosing the right dynamic optimization algorithm", EPE'15-ECCE Europe, 17th European Conference on Power Electronics and Applications, pp. 1–10, 2015.
*My estimate for the percentage of my contribution is **90%**. I prepared and delivered a **dialogue**-style presentation.*

5. Andrzej Gałecki, Arkadiusz Kaszewski, Bartłomiej Ufnalski, Lech Grzesiak, "State Current Controller with Oscillatory Terms for Three-level Grid-connected PWM Rectifiers under Distorted Grid Voltage Conditions", EPE'15-ECCE Europe, 17th European Conference on Power Electronics and Applications, pp. 1–10, 2015.
*My estimate for the percentage of my contribution is 25%. I prepared and delivered a **dialogue**-style presentation.*

6. Michał Małkowski, Bartłomiej Ufnalski, Lech M. Grzesiak, "B-spline based repetitive controller revisited: error shift, higher-order polynomials and smooth pass-to-pass transition", 19th International Conference on System Theory, Control and Computing (ICSTCC), pp. 1–7, 2015.
*I improved the B-spline based repetitive controller. My estimate for the percentage of my contribution is **45%**.*

7. Michał Małkowski, Bartłomiej Ufnalski, Lech M. Grzesiak, "B-spline based repetitive controller for sine wave inverters – choosing the right blending functions", XII Konferencja Naukowa Sterowanie w Energoelektronice i Napędzie Elektrycznym (SENE), pp. 1–6, 2015.
*I improved the B-spline based repetitive controller. My estimate for the percentage of my contribution is **45%**.*

8. Piotr Biernat, Bartłomiej Ufnalski, Lech M. Grzesiak, "Direct particle swarm repetitive controller with time-distributed calculations for real-time implementation", Advances in Intelligent Systems and Computing, 322, pp. 499-508, Springer 2014, ISSN 2194-5357, DOI: 10.1007/978-3-319-11313-5_44.
*I designed the time-distributed swarm calculations. My estimate for the percentage of my contribution is **45%**.*

9. Bartlomiej Beliczynski, Lech M. Grzesiak, Bartlomiej Ufnalski, "Mixed Phenomenological and Neural Approach to Induction Motor Speed Estimation", 16th International Conference on Engineering Applications of Neural Networks (EANN), pp. 1-10, 2015.
*My estimate for the percentage of my contribution is 30%. I prepared and delivered a **lecture**-style presentation.*

10. Lech Grzesiak, Arkadiusz Kaszewski, Bartłomiej Ufnalski, "An efficient discontinuous pulse width modulation algorithm for multileg voltage-source converters", IEEE International Symposium on Industrial Electronics (ISIE), pp. 131–135, 2011.
*I optimized the algorithm. My estimate for the percentage of my contribution is 34%. I prepared and delivered a **dialogue**-style presentation.*

11. Arkadiusz Kaszewski, Bartłomiej Ufnalski, Andrzej Gałecki, Lech Grzesiak, "State-space current control for four-leg grid-connected PWM rectifiers with active power filtering function", 16th International Power Electronics and Motion Control Conference and Exposition (PEMC 2014), pp. 1486–1492, 2014.
My estimate for the percentage of my contribution is 10%.

12. Bartłomiej Ufnalski, Arkadiusz Kaszewski, Lech Grzesiak, "Multi-oscillatory LQR for a three-phase four-wire inverter with $L_{3n}C$ output filter", 38th Annual Conference on IEEE Industrial Electronics Society IECON, pp. 3449 - 3455, 2012.
My estimate for the percentage of my contribution is **40%**. *I prepared and delivered a* **lecture**-*style presentation.* **Best Session Presentation Award**.

13. Marek Michalczuk, Bartłomiej Ufnalski, Lech Grzesiak, "Fuzzy logic control of a hybrid battery-ultracapacitor energy storage for an urban electric vehicle", 8th International Conference and Exhibition on Ecological Vehicles and Renewable Energies (EVER), pp. 1–7, 2013.
My estimate for the percentage of my contribution is **45%**.

14. Arkadiusz Kaszewski, Bartłomiej Ufnalski, Lech Grzesiak, "An LQ controller with disturbance feedforward for the 3-phase 4-leg true sine wave inverter", IEEE International Conference on Industrial Technology (ICIT), pp. 1924-1930, 2013.
My estimate for the percentage of my contribution is **45%**. *I prepared and delivered a* **lecture**-*style presentation.*

15. Arkadiusz Kaszewski, Bartłomiej Ufnalski, Lech Grzesiak, "The LQ controller for the 3-phase 4-leg inverter with an LC output filter – Choosing the right reference frame",15th European Conference on Power Electronics and Applications (EPE), pp. 1–9, 2013.
I optimized the controllers for all three reference frames. My estimate for the percentage of my contribution is **40%**.

16. Bartłomiej Ufnalski, Lech M. Grzesiak, "Neural-network-based programmable state feedback controller for induction motor drive", International Joint Conference on Neural Networks (IJCNN), pp. 1091–1097, 2006.
I invented the programmable state feedback controller. My estimate for the percentage of my contribution is **50%**. *I prepared and delivered a* **lecture**-*style presentation.*

17. Lech M. Grzesiak, Vincent Meganck, Jakub Sobolewski, Bartłomiej Ufnalski, "On-line trained neural speed controller with variable weight update period for direct-torque-controlled AC drive", 12th International Power Electronics and Motion Control Conference (EPE-PEMC), pp. 1127–1132, 2006.
I invented a neurocontroller governed by a variable-rate update mechanism. My estimate for the percentage of my contribution is **40%**. *I prepared and delivered a* **dialogue**-*style presentation.*

18. Lech M. Grzesiak, Vincent Meganck, Jakub Sobolewski, Bartłomiej Ufnalski, "Genetic algorithm for parameters optimization of ANN-based speed controller", IEEE EUROCON Conference, pp. 1700–1705, 2007.
My estimate for the percentage of my contribution is **40%**. *I prepared and delivered a* **dialogue**-*style presentation.*

19. Emil Ernest, Rafal Sztylka, Bartłomiej Ufnalski, Włodzimierz Koczara, "Methods in teaching modern AC drives: inverter-fed motor system with internet-based remote control panel", 12th International Power Electronics and Motion Control Conference (EPE-PEMC), pp. 2130–2133, 2006.

My estimate for the percentage of my contribution is 25%. I prepared and delivered a **lecture***-style presentation.*

20. Lech M. Grzesiak, Bartłomiej Ufnalski, "Selected methods in angular rotor speed estimation for induction motor drives", IEEE EUROCON Conference, pp. 1764–1771, 2007. *I developed novel estimation schemes. My estimate for the percentage of my contribution is* **60%***. I prepared and delivered a* **lecture***-style presentation.*

III.   Teaching, popularization, and international collaboration

A. Participation in national, European and international programmes

1. Tutoring for students within the Erasmus programme.

B. International and national awards for scientific activities other than mentioned in II.M:

1. IEEE IECON 2012 Best Session Presentation Award (Montreal, 26.10.2012).

C. Participation in consortia and research networks

1. Consortium of the "Superconducting magnetic energy storage with a power electronic interface for the electric power systems" (original title: "Nadprzewodzący magazyn energii z interfejsem energoelektronicznym do zastosowań w sieciach dystrybucyjnych") project (01.07.2015–30.06.2018), formed by the Warsaw University of Technology (consortium leader), the University of Zielona Góra (consortium partner), the Electrotechnical Institute (IEL) in Warsaw (consortium partner), and Frako-Term Ltd (consortium partner, an R&D company) – as a co-investigator, **project manager** and **consortium coordinator**.

D. Organization of international and national scientific conferences

1. Member of the organizing committee for the International Conference on Power Electronics and Intelligent Control for Energy Conservation PELINCEC 2005 (www.epe-association.org/epe/documents.php?current=1619).

2. **Chair of the organizing committee** for the IEEE International Conference on "Computer as a Tool" EUROCON 2007 (ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=4400217).

3. Member of the organizing committee (and potentially a future chair) for the 19th European Conference on Power Electronics and Applications EPE'17 ECCE Europe (www.epe2017.com).

4. **Member of the programme committee** for the 12th International Conference on Informatics in Control, Automation and Robotics ICINCO 2015 (IEEE Control Systems Society + IFAC); also invited in the same role to support ICINCO 2016 (www.icinco.org).

5. **Member of the programme committee** for the 2nd IEEE International Conference on Cybernetics CYBCONF 2015 (cybconf2015.am.gdynia.pl/program-committee, reference person: dr hab. inż. Stefan Brock, Stefan.Brock@put.poznan.pl).

6. **Lecture session chair** for the 9th International Conference on Compatibility and Power Electronics CPE 2015 (reference person: prof. João Martins, jf.martins@fct.unl.pt).

7. Reviewer for the 4th International Conference on Renewable Energy Research and Applications ICRERA 2015 (reference person: prof. Ilhami Colak, icolak@gazi.edu.tr).

8. Reviewer for the SENE Conferences (www.sene.p.lodz.pl).

E. Participation in editorial boards of scientific journals

1. Since 2012, I am **associate editor** of IEEE Transactions on Industrial Informatics (IF 8.785).

F. Membership in international and national organizations and scientific societies

1. Institute of Electrical and Electronics Engineers (IEEE) – since 2006.

G. Teaching experience, science communication and popularization

1. **Handbook on control in electric drives (analysis, modeling, and design)** released by Polish Scientific Publishers (Wydawnictwo Naukowe PWN) in early 2016. The handbook is in Polish and is entitled "Sterowanie napędów elektrycznych – analiza, modelowanie, projektowanie" (ISBN: 978-83-01-18318-9, 1st edition). My co-authors are: prof. Lech Grzesiak and Arkadiusz Kaszewski, PhD. The following chapters are my contribution to this handbook: Speed and position controller tuning using particle swarm optimization (Dobór nastaw regulatorów metodą roju cząstek na przykładzie regulatorów prędkości i położenia), Controller tuning in DC drives using SYSTUNE (Strojenie regulatorów przy użyciu SYSTUNE w napędzie prądu stałego), Field oriented control of an AC motor (Sterowanie polowo zorientowane silnikiem indukcyjnym), Stator flux estimation in induction motor drives (Estymatory składowych wektora strumienia stojana maszyny indukcyjnej), Neural-network-based gain-scheduled full state feedback control of an asynchronous motor (Przestrajany siecią neuronową regulator stanu maszyny indukcyjnej) and Angular speed estimation in induction motor drives using neural networks (Odtwarzanie prędkości kątowej silnika indukcyjnego przy użyciu sztucznych sieci neuronowych).

2. Constant development of new and refinement of currently held courses, including lecture and laboratory classes, on computational intelligence in control systems for power electronics and electric drives.

3. Conducting in English lecture and laboratory classes within the Electrical Engineering degree program – currently holds lecture and laboratory class on "Electromechanical drive systems", recently also lecture and laboratory class on "PLC control systems".

4. Conducting in English lecture and laboratory classes within the Industrial Electronics (original name: Elektronika Przemysłowa) degree program – a new lecture and laboratory class on **"Computational intelligence in power electronics and drives"**, scheduled for the first time for the Spring 2016 semester.

5. Constant development of new and refinement of currently held courses on servo drives for automation and robotics, as well as courses on powertrains for hybrid and electric vehicles.

6. Dissemination of knowledge on computational intelligence techniques in power electronics and drives through open access publishing of MATLAB/SIMULINK/Plecs models in the community profile at MATLAB Central (www.mathworks.com/matlabcentral/profile/authors/2128309-bartlomiej-ufnalski). In this respect, it is worth mentioning that the

applicant's models are very popular among MATLAB Central visitors, which is illustrated by average number of downloads per month at the level of 500. The applicant is for many months ranked as **Top 5% Contributor** and his position list number sometimes reaches 100 and above – out of more than 10 000 registered users – and the number of downloads sometimes exceeds **800** per month (www.mathworks.com/matlabcentral/fileexchange/authors?utf8=%E2%9C%93&term=ufnalski).

H. Student supervision

   1. Supervisor for 12 MSc or BSc theses.

I. Tutoring of the PhD students and auxiliary supervision for PhD dissertations

   1. An auxiliary supervisor for PhD canditate Mr Marek Michalczuk, MSc. Registered at EE WUT for the doctoral title conferment procedure on 20 March, 2013, in the field of fuzzy logic control for electric vehicle hybrid powertrains (original proposed dissertation title: Sterowanie rozmyte przepływem energii w pojeździe elektrycznym wyposażonym w baterię ogniw litowych i superkondensatory). I also supervised two Dean's Grants for Doctoral Research related to this undertaking.

   2. An auxiliary supervisor for PhD canditate Mr Andrzej Gałecki, MSc. Registered at EE WUT for the doctoral title conferment procedure on 17 September, 2014, in the field of linear-quadratic control for grid-tie converters (original proposed dissertation title: Sterowanie 3-fazowym przekształtnikiem AC/DC przy zasilaniu napięciem odkształconym z wykorzystaniem liniowo–kwadratowego regulatora stanu). I also supervised the Dean's Grant for Doctoral Research related to this undertaking.

   3. An auxiliary supervisor for PhD canditate Mr Piotr Biernat, MSc. Registered at EE WUT for the doctoral title conferment procedure on 18 March, 2015, in the field of iterative learning control for power electronic converters (original proposed dissertation title: Sterowanie przekształtnikiem DC/AC o sinusoidalnym napięciu wyjściowym wykorzystujące repetycyjny regulator rojowy). I also supervised the Dean's Grant for Doctoral Research related to this undertaking.

J. Technical expert reports

   1. Bartłomiej Ufnalski, Arkadiusz Kaszewski: Assessment of the on-site power supply system for the computing center in Warsaw (original report title: Ekspertyza pomiarowa układów zasilania centrum obliczeniowego zlokalizowanego w hali FSO w Warszawie przy ul. Jagiellońskiej 88). Ordering party: BioInfoBank Institute Ltd. Work completed in January 2015.

K. Evaluating national research grants

   1. External reviewer for National Science Center (Narodowego Centrum Nauki, NCN) – 1 evaluation of a research proposal (2015).

L. Peer reviewing of scientific paper

   1. IEEE Transactions on Industrial Informatics (ieee-ies.org, IF 8.785), permanent reviewer and associate editor since 2012, mainly within the field of computational intelligence in control systems – more than 15 reviews.

   2. IEEE Transactions on Industrial Electronics (ieee-ies.org, IF 6.498) – permanent reviewer, more than 7 reviews.

3. IEEE Transactions on Power Electronics (www.ieee-pels.org, IF 6.008) – 2 reviews.

4. Przegląd Elektrotechniczny (Electrical Review) – permanent reviewer, more than 10 reviews.

5. Metrology and Measurement Systems (www.metrology.pg.gda.pl) – 1 review.

6. IET Control Theory & Applications (www.theiet.org, IF 2.048) – 3 reviews.

7. IET Electrical Systems in Transportation (www.theiet.org) – 1 review.

8. IET Power Electronics (www.theiet.org, IF 1.683) – 1 review

9. TECHNO-Press Smart Structures and Systems (www.techno-press.com, IF 1.368) – 1 review.

10. Studies and Research: Problems concerning electric machines, drives and measurements (original title: Prace Naukowe Instytutu Maszyn, Napędów i Pomiarów Elektrycznych Politechniki Wrocławskiej) – 3 reviews.

11. Archives of Electrical Engineering (www.aee.put.poznan.pl) – 1 review.

12. ELSEVIER Engineering Science and Technology, an International Journal (JESTECH, www.journals.elsevier.com/engineering-science-and-technology-an-international-journal) – 1 review.

M. Organizational achievements and functions

1. Deputy Director for Science and Research at the Institute of Control and Industrial Electronics

2. Elected Faculty Council Member

3. Member of the Commission for Science and Research within the Faculty Council

4. Secretary of the Dean's Commission for Doctoral Degree Conferment Procedure

5. Member of the Graduation Exam Commission within the Electrical Drive Division.

N. Total number of points according to the criteria and procedure for granting the category of scientific research units in Poland (2009–2015, isod.ee.pw.edu.pl/isod-nauka/public): **554** points, or **261** points if only the applicant's shares are taken into account.

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Applicant's signature