

# Curriculum Vitae

## Łukasz Breńkacz

Phone: +48 58 5225 264  
Email: lukasz.brenkacz@imp.gda.pl  
Website: www.brenkacz.com



### Education

- **2011–2016 PhD studies**, Gdańsk University of Technology, field: Technical Sciences, discipline: Mechanics and Machine Construction, specialization: Machine Dynamics. **PhD thesis was honoured by the Scientific Council of the Institute of Fluid Flow Machinery, Polish Academy of Sciences.**
- **2014–2015 Postgraduate studies**, High School of Banking in Gdańsk, Poland, "Manager of R&D projects".
- **2008–2013 Engineering studies**, University of Warmia and Mazury, a field of study: Informatics, specialization: Information Systems Engineering.
- **2009–2011 Master studies**, University of Warmia and Mazury, a field of study: Mechanics and Machine Construction, specialization: Engineering Use of Computers in Machine Construction.
- **2005–2009 Engineering studies**, University of Warmia and Mazury, Olsztyn, Poland, a field of study: Mechanics and Machine Construction, **Studies graduated with honours.**

### Experience

- **01.04.2017 – to the present day** – Working as an **assistant professor**. Institute of Fluid Flow Machinery, Polish Academy of Sciences, Fiszera 14, 80–231 Gdańsk, Poland.
- **01.04.2011–30.03.2017** – Working as a **specialist and a scientific assistant**. Institute of Fluid Flow Machinery, Polish Academy of Sciences, Fiszera 14, 80–231 Gdańsk, Poland.
- **01.04.2013–31.03.2014** – Working as a **research engineer**. One-year practice under the framework of the European Union program: Marie Curie STA-DY-WI-CO. LMS International, the Siemens Business. Research park 1237, Interleuvelaan 68, Leuven, Belgium.
- **24.03.2010–18.06.2010** – Contract: Analysis of the tension in the loom. Michelin Poland S.A., Leonharda 9, 10–453 Olsztyn, Poland.
- **13.07.2009–30.09.2009** – **GATX Rail Poland Sp. z o.o.** Twarda 30, 00–831 Warsaw, Poland
- **01.09.2006–30.09.2006, 20.08.2007–28.09.2007** – Practice at the **Serwis sklejka Sp. Z o.o.** Mazurska 1, 14–300 Morąg, Poland.



## Additional information

- Skills to write scripts using the Matlab software – also with a GUI.
- Experience with balancing shafts and shaft alignments.
- Training Vibration Analyst: Category II, ISO 18436–2, Mobius Institute, June 24–28, 2019, Wrocław, Poland
- Training FEM for practitioners, January 10–22, 2020, Gdańsk, Poland
- Training: Modal Analysis of Nonlinear Mechanical Systems, June 25–29, 2012, Udine, Italy.
- Training: ISMA course: Modal analysis, theory and practice, September 18–19, 2013, Leuven, Belgium.
- Training: Computational Fluid-Structure Interaction, November 20–24, 2017, Gdańsk, Poland.
- Training: Entrepreneurial skills, October 17–18, 2013, Leuven, Belgium.
- Training: LMS Test.Lab rotating machinery testing, May 23–24, 2013, Leuven, Belgium.
- Training: Samcef Field Rotor, May 14–15, 2013, Liege, Belgium.
- Training: Samcef Field Rotor Advanced, May 16–17, 2013, Liege, Belgium.
- Training: Advanced methods and solutions for structural testing, June 11–13, 2013, Leuven, Belgium.
- An expert in the SIMP (Polish Society of Mechanical Engineers and Technicians) organization in the two fields. 1 - IT techniques and 2 - the strength of materials and constructions.
- Master's thesis was awarded in the competition "The 12<sup>th</sup> edition of the national competition for the SIMP President's award for the best diploma dissertation made and defended at a national technical university in the field of mechanics in the school year 2010/2011".
- Several years of work with CAD, CAE programs approved by the following certificates:
  - AutoCAD 2007 Essentials certificate (No. 2331816).
  - Autodesk Inventor 11 Essentials certificate (No. 2331837).
  - Autodesk Inventor 2010 Essentials certificate (No. 1EKRK04983).
  - Solid Works students' certificate (No. 166-2008/2009).
  - Certificate of completion: Introduction to Abaqus/Standard, Abaqus/Explicit and Abaqus CAE (May 16–20, 2011).
  - Certificate of completion: Introduction to Python and Scripting in Abaqus. (October 10–11, 2011).
  - Certificate of completion: Writing User Subroutines with Abaqus.

## Interests

- Krav Maga.
- Water sports (diving, swimming, sailing).
- Jogging.
- Digital photography.
- Calligraphy.

## Publications (until September 2021)

### Articles

1. Breńkacz Łukasz, Witanowski Łukasz, Drosińska-Komor Marta, Szewczuk-Krypa Natalia, *Research and applications of active bearings: A state-of-the-art review*, Mechanical Systems and Signal Processing, Vol. 151, p. 107423, 2021.
2. Breńkacz Łukasz, Bagiński Paweł, Żywica Grzegorz, *Experimental research on foil vibrations in a gas foil bearing carried out using an ultra-high-speed camera*, Applied Sciences, Vol. 11, Issue 2, p. 878, 2021.
3. Blaut Jędrzej, Breńkacz Łukasz, *Application of the Teager-Kaiser energy operator in diagnostics of a hydrodynamic bearing*, Eksploatacja i Niezawodność – Maintenance and Reliability, Vol. 33, Issue 4, pp. 757–765, 2020.
4. Breńkacz Łukasz, Bagiński Paweł, Korbicz Jarosław K., *Vibration damping of the anti-vibration platform intended for use in combination with audio/music devices*, Journal of Vibroengineering, Vol. 22, Issue 3, pp. 578–593, 2020.
5. Żywica Grzegorz, Kaczmarczyk Tomasz Z., Breńkacz Łukasz, Bogulicz Małgorzata, Andrearczyk Artur, *Investigation of dynamic properties of the microturbine with a maximum rotational speed of 120 krpm – predictions and experimental tests*, Journal of Vibroengineering, Vol. 22, Issue 2, pp. 298–312, 2020.
6. Breńkacz Łukasz, Żywica Grzegorz, Bogulicz Małgorzata, *Selection of the oil-free bearing system for a 30 kW*, Journal of Vibroengineering, Vol. 21, Issue 2, pp. 318–330, 2019.
7. Żywica Grzegorz, Breńkacz Łukasz, Bagiński Paweł, *Interactions in the rotor-bearings-support structure system of the multi-stage ORC microturbine*, Journal of Vibration Engineering & Technologies, Vol. 6, pp. 369–377, 2018.
8. Szewczuk-Krypa Natalia, Drosińska-Komor Marta, Głuch Jerzy, Breńkacz Łukasz, *Comparison Analysis of Selected Nuclear Power Plants Supplied with Helium from High-Temperature Gas-Cooled, Reactor*, Polish Maritime Research, Vol. 25, Issue S1(97), pp. 204–210, 2018.
9. Breńkacz Łukasz, Żywica Grzegorz, Bogulicz Małgorzata, *Numerical analysis of the rotor of a 30 kW ORC microturbine considering properties of aerodynamic gas bearings*, Mechanics and Mechanical Engineering, pp. 425–435, 2018.
10. Breńkacz Łukasz, Żywica Grzegorz, Drosińska-Komor Marta, Szewczuk-Krypa Natalia, *The experimental determination of bearings dynamic coefficients in a wide range of rotational speeds, taking into account the resonance and hydrodynamic instability*, Springer Proceedings in Mathematics and Statistics, pp. 13–24, 2018.
11. Żywica Grzegorz, Breńkacz Łukasz, Bagiński Paweł, *Interactions in the rotor-bearing support structure system of the multi-stage ORC microturbine*, Journal of Vibration Engineering & Technologies, Issue 6, pp. 369–377, 2018.
12. Breńkacz Łukasz, Żywica Grzegorz, Drosińska-Komor Marta, *The experimental identification of the dynamic coefficients of two hydrodynamic journal bearings operating at constant rotational speed and under nonlinear conditions*. Polish Maritime Research, 4(96), Vol. 24, pp. 108–115, 2017

13. Breńkacz Łukasz, Żywica Grzegorz, *Comparison of experimentally and numerically determined dynamic coefficients of the hydrodynamic slide bearings operating in the nonlinear rotating systems*, Proceedings of the ASME Turbo Expo 2017: Turbomachinery Technical Conference and Exposition, Charlotte, NC, USA, 2017.
14. Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, Miąskowski Wojciech, Pietkiewicz Paweł, Nalepa Krzysztof, *Dynamic state assessment of the high-speed rotor based on a structural-flow model of a foil bearing*, Diagnostyka, Vol. 18, Issue 1, 2017, pp. 95–102.
15. Andrearczyk Artur, Żywica Grzegorz, Breńkacz Łukasz, Bagiński Paweł, *Vibration based diagnostic of the multi-stage microturbine operating in the medium-temperature ORC system*, Vibroengineering PROCEDIA, 13, 2017, pp. 56–61.
16. Breńkacz Łukasz, Żywica Grzegorz, Bogulicz Małgorzata, *Analysis of dynamical properties of a 700 kW turbine rotor designed to operate in an ORC installation*, Diagnostyka Vol. 17, No. 2 (2016), pp. 17–23, 2016.
17. Breńkacz Łukasz, Żywica Grzegorz, *An experimental investigation conducted in order to determine bearing dynamic coefficients of two hydrodynamic bearings using impulse responses*, Transactions of the Institute of Fluid-Flow Machinery, 133, 2016, pp. 39–54.
18. Breńkacz Łukasz, Żywica Grzegorz, *Numeryczne wyznaczanie liniowych i nieliniowych współczynników sztywności i tłumienia poprzecznych łożysk hydrodynamicznych [Numerical estimation of linear and nonlinear stiffness and damping coefficients of journal hydrodynamic bearings]*, Mechanik, 7/2016, pp. 648–649.
19. Breńkacz Łukasz, Żywica Grzegorz, *The sensitivity analysis of the method for identification of bearing dynamic coefficients*, Dynamical Systems – Modeling, Springer Proceedings, pp. 81–96, 2016.
20. Breńkacz Łukasz, *Identification of stiffness, damping and mass coefficients of rotor-bearing system using impulse response method*, Journal of Vibroengineering, Vol. 17, Issue 5, pp. 2272–2282, 2015.
21. Breńkacz Łukasz, *Identification of bearing dynamic coefficients with consideration of shaft unbalance*, Mechanik, 7/2015, pp. 57–64.
22. Breńkacz Łukasz, Bykuć Sebastian, Żywica Grzegorz, Kaczmarczyk Tomasz, *The laboratory test stand of the ORC micro power plant*, Ciepłne Maszyny Przepływowe - Turbomachinery 146/2014, pp. 47–56.
23. Bagiński Paweł, Żywica Grzegorz, Breńkacz Łukasz, *The test rig and investigation of the high-speed rotor supported by foil bearings at increased temperature*, Ciepłne Maszyny Przepływowe - Turbomachinery 146/2014. pp. 31–44.
24. Breńkacz Łukasz, Bogulicz Małgorzata, Bagiński Paweł, *Dynwir S-70 program for modal analysis of multisupported and multimass rotors*, Diagnostyka Vol. 14, no. 1 (2013), pp. 25–30, 2013.
25. Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, *Dynamic state assessment of the water turbine with the power of 600 kW*, Diagnostyka Vol. 14, no. 1 (2013), pp. 65–70, 2013.
26. Bagiński Paweł, Breńkacz Łukasz, Łuczak Marcin, *Analiza modalna konstrukcji stanowiska badawczego dynamiki małogabarytowych wirników przy wykorzystaniu wzbudników drgań. Część I. Badania eksperymentalne [Modal analysis of construction of the small scale rotor dynamics test rig using vibration exciter. Part I. Experimental study]*, Mechanik, 7/2012, s. 21–30 CD.

27. Breńkacz Łukasz, Bagiński Paweł, Żywica Grzegorz, *Analiza modalna konstrukcji stanowiska badawczego dynamiki małogabarytowych wirników przy wykorzystaniu wzbudników drgań. Część druga – badania symulacyjne [Modal analysis of the construction of the small scale rotor dynamics test rig using vibration exciter. Part two – simulation study]*, *Mechanik*, 7/2012, pp. 31–36 CD.
28. Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, *Stanowisko do badania łożysk foliowych w cyklu start-stop [Stand for the foil bearing test in the start-stop cycle]*, *Mechanik*, 7/2012, pp. 479–484 CD.
29. Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, *Modelowanie i analiza hydrodynamicznych łożysk foliowych [Modeling and analysis of hydrodynamic foil bearings]*, *Mechanik*, 7/2012, pp. 1043–1050.
30. Breńkacz Łukasz, Domański Jerzy, Jastrząbek Zbigniew, Miąskowski Wojciech, Pietkiewicz Paweł, Nalepa Krzysztof, *Modelowanie śruby napędowej batyskafu. Badanie doświadczalne dyszy Korta [The modeling of propeller of the bathyscaphe corte'a nozzle]*, *Mechanik*, 7/2011.
31. Breńkacz Łukasz, Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, *Weryfikacja doświadczalna analizy numerycznej stanowiska do badania silników wiatrowych [Experimental verification of numerical analysis of the stand for the wind turbines tests]*, *Mechanik*, 7/2011, pp. 57–64.
32. Breńkacz Łukasz, Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, *Analiza inżynierska stanowiska do badania silników wiatrowych [Engineering analysis off the wind turbines research stand]*, *Mechanik*, 7/2010, pp. 37–44.
33. Breńkacz Łukasz, Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, *Uniwersalne stanowisko do badania elementów siłowni wiatrowych – rozważania koncepcyjne [Universal test stand for wind turbine components - conceptual considerations]*, *Mechanik*, 7/2010 pp. 45–52.

## Books

34. Breńkacz Łukasz, *Bearing dynamic coefficients in rotordynamics: Computation Methods and Practical Applications*, John Wiley & Sons Ltd., 2021.

## Chapters in monographs

35. Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, *Monograph: Dynamika i diagnostyka maszyn wirnikowych – lata badań i doświadczeń [Dynamics and Diagnostics of rotating machinery – years of research and experience]*, Chapter: *Analiza właściwości dynamicznych mikroturbin energetycznych [Analysis of dynamic properties of energy microturbines]*, Publisher: Institute of Fluid-Flow Machinery, Polish Academy of Sciences, Collective work edited by Jan Kiciński, Gdańsk, 2018.
36. Breńkacz Łukasz, *Monograph: Współczesne technologie i konwersja energii [Modern technologies and energy conversion]*, chapter: *Badania charakterystyk dynamicznych maszyn wirnikowych [Testing of dynamic characteristics of rotating machinery]*, pp. 55–62, Publisher: Wydział Mechaniczny, Politechnika Gdańska [Mechanical Department, Gdańsk University of Technology], Collective work edited by Jan Szantyr, Gdańsk, Poland, 2013.
37. Breńkacz Łukasz, *Monograph: Współczesne technologie i konwersja energii [Modern technologies and energy conversion]*, chapter: *Algorytmy analizy modalnej [Algorithms of modal analysis]*, pp. 41–48, Publisher: Wydział Mechaniczny, Politechnika Gdańska [Mechanical Department, Gdańsk University of Technology], Collective work edited by Jan Szantyr, Gdańsk, Poland 2012.



## Publications in post-conference materials

38. Breńkacz Łukasz, Natalia Szewczuk-Krypa, *Taking into account fluid-structure interactions in the basic control model of an active foil bearing*, Proceedings of the 9th Wdzydzeanum Workshop on Fluid – Solid Interaction, Institute of Fluid Flow Machinery, Polish Academy of Sciences, Wdzydze Kiszewskie, Poland, p. 7, 5–10.09.2021.
39. Breńkacz Łukasz, Żywica Grzegorz, Bogulicz Małgorzata, *Selection of the Bearing System for a 1 kW ORC Microturbine, Mechanisms and Machine Science*, Proceedings of the 10th International Conference on Rotor Dynamics – IFToMM. IFToMM, Springer, pp. 223–235, 2019.
40. Żywica Grzegorz, Breńkacz Łukasz, Bagiński Paweł, *Dynamic interactions in the rotor-bearing-support structure system of the multi-stage ORC microturbine*, VETOMAC XII International Conference on Vibration Engineering and Technology of Machinery, pp. 195–207, 2018
41. Breńkacz Łukasz, Żywica Grzegorz, *The experimental identification of the dynamic coefficients for two hydrodynamic journal bearings*, SIRM 2017 – 12th International Conference on Vibrations in Rotating Machines, Graz, Austria, 15–17.02.2017.
42. Breńkacz Łukasz, Żywica Grzegorz, *Eksperymentalne wyznaczenie współczynników dynamicznych łożysk hydrodynamicznych – badania wstępne [Experimental identification of bearing dynamic coefficients –preliminary research]*, XLIV Ogólnopolskie Sympozjum Diagnostyka Maszyn [XLIV Nationwide Symposium of Machine Diagnostics] 2017, Wisła, Poland, 26.02–02.03.2017, pp. 14–15.
43. Breńkacz Łukasz, Żywica Grzegorz, *Analiza właściwości dynamicznych turbiny 700 kW pracującej w obiegu ORC [Analysis of dynamical properties of a 700 kW turbine rotor designed to operate in an ORC installation]*, XLIII Ogólnopolskie Sympozjum Diagnostyka Maszyn [XLIII Nationwide Symposium of Machine Diagnostics], Wisła, Poland, 29.02–04.03.2016, pp. 16, 2016.
44. Breńkacz Łukasz, Żywica Grzegorz, *Numeryczne wyznaczanie liniowych i nieliniowych współczynników sztywności i tłumienia poprzecznych łożysk hydrodynamicznych [Numerical estimation of linear and nonlinear stiffness and damping coefficients of journal hydrodynamic bearings]*, XX Międzynarodowa szkoła komputerowego wspomaganie projektowania, wytwarzania i eksploatacji [XX International school of computer-aided design, manufacturing and operation], Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology], 16–20.05.2016, pp. 51–56.
45. Bykuć Sebastian, Breńkacz Łukasz, Żywica Grzegorz, *Start-up research on the laboratory micro CHP ORC test stand*, 3rd International Seminar on ORC Power Systems, Brussels, Belgium, 12–14.09.2015.
46. Breńkacz Łukasz, *Identyfikacja współczynników dynamicznych łożysk z uwzględnieniem niewyważenia wału [Identification of bearing dynamic coefficients with consideration of shaft unbalance]*, XIX Międzynarodowa szkoła komputerowego wspomaganie projektowania, wytwarzania i eksploatacji [XIX International school of computer-aided design, manufacturing and operation], Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology], 11–15.05.2015, pp. 65–72.
47. Breńkacz Łukasz, *Metoda impulsowa wyznaczania współczynników sztywności, tłumienia i masy łożysk [Impulse method for determining stiffness, damping and mass coefficients of bearings]*, XLII Ogólnopolskie Sympozjum Diagnostyka Maszyn [XLII Nationwide Symposium of Machine Diagnostics], Wisła, Poland, 02.03–03.03.2015, pp. 19.
48. Żywica Grzegorz, Breńkacz Łukasz, *Analiza właściwości dynamicznych prototypowego turbozespołu ORC o mocy 100 kWe [Analysis of dynamic properties of the ORC turbine prototype*

- with a capacity of 100 kWe*], XLII Ogólnopolskie Sympozjum Diagnostyka Maszyn [XLII Nationwide Symposium of Machine Diagnostics], Wisła, Poland, 02.03–03.03.2015, pp. 79.
49. Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, *Ocena stanu dynamicznego turbiny wodnej o mocy 600 kW* [Dynamic state assessment of the water turbine with an electric power of 600 kW], XL Ogólnopolskie Sympozjum Diagnostyka Maszyn [XL Nationwide Symposium of Machine Diagnostics], Wisła, Poland, 04.03–08.03.2013, pp. 73.
  50. Bagiński Paweł, Breńkacz Łukasz, Łuczak Marcin, *Analiza modalna konstrukcji stanowiska badawczego dynamiki małowabarytowych wirników przy wykorzystaniu wzbudników drgań część 1. Badania eksperymentalne* [Modal analysis of the construction of the test rig of small rotors using a vibration exciter. Part one – experimental Research], XVI Międzynarodowa szkoła komputerowego wspomaganie projektowania, wytwarzania i eksploatacji [XVI International school of computer-aided design, manufacturing and operation], Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology], 14–18.05.2012, pp. 21–30.
  51. Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, *Test rig for testing foil bearings under start-stop cycles*, XVI International school of computer-aided design, manufacturing, and operation, Jurata, Poland, 14–18.05.2012, Military University of Technology, pp. 475–480.
  52. Bagiński Paweł, Breńkacz Łukasz, Żywica Grzegorz, *Analiza modalna konstrukcji podpierającej stanowiska badawczego dynamiki małowabarytowych wirników. Część pierwsza – badania eksperymentalne* [Modal analysis of the construction of the test rig of small rotors Part one – experimental research], XXXIX Ogólnopolskie Sympozjum Diagnostyka Maszyn [XXXIX Nationwide Symposium of Machine Diagnostics], Wisła, Poland, 05–10.03.2012, pp. 27, 2012
  53. Breńkacz Łukasz, Bagiński Paweł, Żywica Grzegorz, *Analiza modalna konstrukcji podpierającej stanowiska badawczego dynamiki małowabarytowych wirników. Część druga – badania symulacyjne* [Modal analysis of the construction of the test rig of small rotors Part two – simulation research], XXXIX Ogólnopolskie Sympozjum Diagnostyka Maszyn [XXXIX Nationwide Symposium of Machine Diagnostics] 2012, Wisła, Poland, 05–10.03.2012, pp. 29.
  54. Żywica Grzegorz, Bagiński Paweł, Breńkacz Łukasz, Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, *Modelowanie i analiza hydrodynamicznych łożysk foliowych* [Modeling and analysis of hydrodynamic foil bearings], XVI Międzynarodowa szkoła komputerowego wspomaganie projektowania, wytwarzania i eksploatacji [XVI International school of computer-aided design, manufacturing and operation], Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology], 14–18.05.2012 pp. 523–530.
  55. Breńkacz Łukasz, Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, *Weryfikacja doświadczalna analizy numerycznej stanowiska do badania silników wiatrowych* [Experimental verification of numerical analysis of the stand for the wind turbines tests], XV Międzynarodowa szkoła komputerowego wspomaganie projektowania, wytwarzania i eksploatacji [XV International school of computer-aided design, manufacturing, and operation], Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology], 9–13.05.2011, pp. 57–64.
  56. Breńkacz Łukasz, Domański Jerzy, Jarząbek Zbigniew, Miąskowski Wojciech, Pietkiewicz Paweł, Nalepa Krzysztof, *Modelowanie śruby napędowej batyskafu. Badania doświadczalne dyszy Corte'a* [Modeling of bathscaph's screw propeller – Experiments on Kort nozzle], XV Międzynarodowa szkoła komputerowego wspomaganie projektowania, wytwarzania i eksploatacji [XV International school of computer-aided design, manufacturing and operation], Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology], 09–13.05.2011, pp. 51–56.
  57. Breńkacz Łukasz, Miąskowski Wojciech, Pietkiewicz Paweł, *Estimation of zero buoyancy of the bathyscaphe. Pneumatic buoyancy control of the bathyscaphe*, 14<sup>th</sup> International Symposium of

students and young mechanical engineers: Advances in chemical and mechanical engineering, Gdańsk, 05–07.05.2011.

58. Breńkacz Łukasz, Gocłowski Piotr, Nowicki Krystian, Pietkiewicz Paweł, Miąskowski Wojciech, *Transmisja obrazu oraz sterowanie batyskafem [Video transmission and control of the bathyscaphe]*, XVI International conference of student circles and XXVIII Sejmik SKN, Wrocław, Poland, University of Life Sciences in Wrocław, 12–13.05.2011.
59. Breńkacz Łukasz, Miąskowski Wojciech, Nalepa Krzysztof, Pietkiewicz Paweł, *Uniwersalne stanowisko do badania elementów siłowni wiatrowych – rozważania koncepcyjne [Universal test stand for wind turbine components – conceptual considerations]*, XIV Międzynarodowa szkoła komputerowego wspomaganie projektowania, wytwarzania i eksploatacji [XIV International school of computer-aided design, manufacturing and operation], Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology], 10–14.05.2010, pp. 37–44.
60. Breńkacz Łukasz, Miąskowski Wojciech, *Stanowisko do badania systemów łożyskowania wirników szybkoobrotowych [Test rig for examining high-speed bearings]*, XIII International school of computer-aided design, manufacturing and operation, Jurata, Poland, Wojskowa Akademia Techniczna [Military University of Technology] 11–15.05.2009, pp. 43–54.

### Patent applications

61. Breńkacz Łukasz, Bagiński Paweł, Andrearczyk Artur, Aktywne łożysko foliowe [Active foil bearing], Zgłoszenie patentowe oznaczone numerem: P. 432714 wysłane do urzędu patentowego 27.01.2020.
62. Breńkacz Łukasz, Bagiński Paweł, Andrearczyk Artur, Sterowanie aktywnym łożyskiem foliowym [Control of active foil bearing], Zgłoszenie patentowe oznaczone numerem: P. 432714 wysłane do urzędu patentowego 27.01.2020.

### Description of some projects completed successfully

- **I made dynamic calculations and the selection of bearings** of a 1 kW ORC microturbine. The work (that is ongoing) involves analysing the rolling bearing system and the bearing system that uses a low-boiling medium in the liquid phase and the vapour phase. In parallel with the decision-making process, I have analysed the dynamic properties of the rotor.
- **Bearing system optimization** of a 3 kW ORC turbine. Analysis of gas bearings, including geometry changes and a different placement of feeding holes to minimize wear and gas usage.
- **I made dynamic calculations and the selection of bearings** of a 30 kW ORC turbine. The work included an analysis of the bearing system that uses a low-boiling medium in the liquid or vapour state. Rolling bearings were also considered and analysed. Simultaneously with the selection of the bearings, the dynamic properties of the rotor were investigated.
- **I made dynamic calculations and the selection of bearings** of a 700 kW ORC turbine. The rotor was equipped with standard multi-plate hydrodynamic bearings.
- Participation in the **construction of the diagnostic system** for a 700 kW turbine
- **Analysis of the bearing system and dynamic calculations** of the oil-free radial refrigeration compressor. The project aimed to develop the technology of high-speed, oil-free, and hermetic radial refrigeration compressors. The analysed bearing system included gas bearings.
- We have performed **experimental and numerical modal analyses**. One example is the structure supporting a rotor, which was tuning the parameters of numerical models.



- **I was designing several test rigs, for example, a 3 kW ORC turbine test stand.** This project included a turbine, a pump, heat exchangers and all necessary connections.
- Several **expert opinions** such as strength/dynamic analyses, for example, chain strength analysis, water turbine vibration analysis.

### List of scientific projects

- Active gas foil bearings with variable dynamic properties (originally in Polish: Aktywne łożyska foliowe ze zmiennymi właściwościami dynamicznymi), project No. LIDER/51/0200/L9/17/NCBR/2018), implemented as part of the research and development program called "LEADER" (originally in Polish: "LIDER"). | **Project manager**
- Adequacy ranges of linear and nonlinear methods for determining the dynamic properties of the rotating machinery (originally in Polish: Przedziały adekwatności liniowych i nieliniowych metod określania właściwości dynamicznych łożysk hydrodynamicznych), Preludium 9 program, awarding institution: National Science Centre Poland | **Project manager**
- Low and medium power, oil-free, radial refrigeration compressors with innovative, hermetic design (originally in Polish: Bezolejowe, promieniowe sprężarki chłodnicze małej i średniej mocy o innowacyjnej, hermetycznej konstrukcji) (project No. LIDER/12/0073/L-8/16/NCBR/2017) | **Project contractor**
- Model agroenergy complexes as an example of distributed cogeneration based on local renewable energy sources (originally in Polish: Modelowe kompleksy agroenergetyczne jako przykład kogeneracji rozproszonej opartej na lokalnych i odnawialnych źródłach energii) (project No. POIG. 01.01.02-00-016/08) | **Project contractor**
- Developing integrated technologies of fuel and energy production from biomass, agricultural wastes and other resources (originally in Polish: Opracowanie zintegrowanych technologii wytwarzania paliw i energii z biomasy, odpadów rolniczych i innych) (research task No. 4 of the strategic program (Advanced Technologies for Energy Generation)) | **Project contractor**
- Using intelligent materials and structures to develop and implement the concept of the innovative bearing system in power microturbine rotors (originally in Polish: Wykorzystanie materiałów i konstrukcji inteligentnych do opracowania koncepcji i wykonania innowacyjnego systemu łożyskowania wirników mikroturbin energetycznych) (project No. POIG.01.03.01-00-027/08) | **Project contractor**
- Universal gas turbine micro-cogeneration system (originally in Polish: Uniwersalny turbogazowy układ mikrokogeneracyjny) (project No. POIR.04.01.04-00-014/17) | **Project contractor**

### Conferences and delivered presentations

- **9<sup>th</sup> Wdzydzeanum Workshop on Fluid – Solid Interaction**, “Talking into account fluid-structure interactions in the basic control model of an active foil bearing”, **Wdzydze Kiszewskie, Poland**, 5–10.09.2021.
- **SIRM 2021 – Dynamics of Rotating Machines**, "Dynamics of a rotor supported by active foil bearings – a numerical study ", **Gdańsk, Poland (online)**, 17–19.02.2021,
- **The 15<sup>th</sup> International Conference on Motion and Vibration Control MoVic 2020**, "The basic control model of an active foil bearing", **Niigata, Japan (online)**, 8–11.12.2020.
- **SIRM 2019 – 13<sup>th</sup> International Conference on Dynamics of Rotating Machines**, "Analysis of displacements in a gas foil bearing using an ultra-high-speed camera", **Copenhagen, Denmark**, 13–15.02.2019.

- **IFTToMM 2018 Rotordynamics**, "Selection of the bearing system for a 1 kW ORC microturbine", **Rio de Janeiro, Brazil**, 23–27.09.2018.
- **Dynamical Systems – theory and applications 2017**, "The experimental determination of bearings dynamic coefficients in a wide range of rotational speeds, taking into account the resonance and hydrodynamic instability", **Łódź, Poland**, 11–14.12.2017.
- **31<sup>st</sup> Workshop on Turbomachinery 2017**, "Bearings for 1 kW ORC microturbine", **Dresden, Germany**, 4–6.10.2017.
- **ASME TURBO EXPO Turbomachinery Technical Conference & Exposition 2017**, "Comparison of experimentally and numerically determined dynamic coefficients of the hydrodynamic slide bearings operating in the nonlinear rotating system", **Charlotte, North Carolina, USA**, 26–30.2017.
- **Schwingungen in rotierenden Maschinen SIRM 2017**, "The experimental identification of the dynamic coefficients for two hydrodynamic journal bearings", **Graz, Austria**, 15–17.02.2017.
- **XLIV Nationwide Symposium of Machine Diagnostics 2017** Experimental identification of bearing dynamic coefficients –preliminary research (originally in Polish: Eksperymentalne wyznaczanie współczynników dynamicznych łożysk hydrodynamicznych – badania wstępne), **Wisła, Poland**, 26.02–02.03.2017.
- **12<sup>th</sup> International Symposium SYMKOM 2016**, "An experimental investigation to determine bearing dynamic coefficients of two hydrodynamic bearings using impulse responses", **Gdańsk, Poland**, After the presentation, the Scientific Committee of the Conference awarded the prize: "**First prize in Young Researchers' Award Competition**" 18–19.10.2016.
- **XLIII Nationwide Symposium of Machine Diagnostics 2016**, Analysis of dynamical properties of a 700 kW turbine rotor designed to operate in an ORC installation (originally in Polish: Analiza właściwości dynamicznych turbiny 700 kW pracującej w obiegu ORC), **Wisła, Poland**, 29.02–04.03.2016.
- **XX International school of computer-aided design, manufacturing and operation**, *Numerical estimation of linear and nonlinear stiffness and damping coefficients of journal hydrodynamic bearings*, **Jurata, Poland**, 16–20.05.2016.
- **XLII Nationwide Symposium of Machine Diagnostics 2015**, *Impulse method for determining stiffness, damping and mass coefficients of bearings* (originally in Polish: Metoda impulsowa wyznaczania współczynników sztywności, tłumienia i masy łożysk), **Wisła, Poland**, 02.03–03.03.2015.
- **XVI International school of computer-aided design, manufacturing and operation**, *Modal analysis of the construction of the test rig of small rotors using a vibration exciter. Part one – experimental research*, **Jurata, Poland**, 14–18.05.2012.
- **XXXIX Nationwide Symposium of Machine Diagnostics 2012**, *Modal analysis of the construction of the test rig of small rotors Part two – simulation research* (originally in Polish: Analiza modalna konstrukcji podpierającej stanowiska badawczego dynamiki małogabarytowych wirników. Część druga – badania symulacyjne), **Wisła, Poland**, 05–10.03.2012.
- **XV International school of computer-aided design, manufacturing, and operation**, *Experimental verification of numerical analysis of the stand for the wind turbines tests*, **Jurata, Poland**, 9–13.05.2011.
- **XV International school of computer-aided design, manufacturing and operation**, *Modeling of bathscaph's screw propeller – Experiments on Kort nozzle*, **Jurata, Poland**, 09–13.05.2011.
- **14th International Symposium of students and young mechanical engineers: Advances in chemical and mechanical engineering**, Estimation of zero buoyancy of the bathyscaphe. Pneumatic buoyancy control of the bathyscaphe, **Gdańsk, Poland**, 05–07.05.2011.

- **XVI International conference of student circles and XXVIII Sejmik SKN**, *Video transmission and control of the bathyscaphe (originally in Polish: Transmisja obrazu oraz sterowanie batyskafem)*, **Wrocław, Poland**, University of Life Sciences in Wrocław, 12–13.05.2011.
- **XIV International school of computer-aided design, manufacturing, and operation**, Universal test stand for wind turbine components – conceptual considerations (originally in Polish: Uniwersalne stanowisko do badania elementów siłowni wiatrowych – rozważania koncepcyjne), **Jurata, Poland**, 10–14.05.2010.
- **XIII International school of computer-aided design, manufacturing and operation**, Test rig for examining high-speed bearings (*originally in Polish: Stanowisko do badania systemów łożyskowania wirników szybkoobrotowych*), **Jurata, Poland**, 11–15.05.2009.

## Summary

I design and make calculations of bearings and rotating machinery. I am interested in vibration-based health monitoring of bearings. At work, I use numerical methods and perform experimental research. For several years, I have been dealing with rotor dynamics related to the selection of bearings for high-speed microturbines. My research interests include hydrodynamic, gas, rolling, and foil bearings. I am an author or co-author of several expert opinions and about 60 scientific publications, and I participated in 9 research projects, two of them as a project manager. I am currently the manager of a research project entitled "Active foil bearing with variable dynamic properties", which is financed by the NCBR.

I am a mechanical engineer who designs various devices, usually laboratory test rigs. I am also an IT engineer who writes my calculation codes when I need them, such as signal processing. In my doctoral dissertation, I investigated the properties of hydrodynamic bearings, i.e. stiffness and damping coefficients. In my professional work, I perform FEM (Finite Element Method) analyses and numerical and experimental modal analyses (for instance, using Abaqus and LMS Test.Lab).