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**Procedure for qualifying as associate professor in the field of
Technical Sciences in discipline of Mechanics**

ABSTRACT OF SCIENTIFIC ACHIEVEMENTS

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Lublin, December 2012

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1. CURRICULUM VITAE

Date and place of birth	November 5, 1973, Lublin
Education	1988-1993 Technical Secondary School in Lublin 1993-1998 Lublin University of Technology, Mechanical Engineering Faculty stationary studies, specialty: Mechanics and Mechanical Engineering 1997-1999 Centre of Managers Education in Lublin, postgraduate studies 2000-2004 Lublin University of Technology, Mechanical Engineering Faculty, PhD studies
Positions	1998-2005 Assistant in Department of Applied Mechanics, Lublin University of Technology od 2005 Assistant Professor in Department of Applied Mechanics, LUT
Qualification	1998 MSc Eng., Lublin University of Technology, Mechanical Engineering Faculty, Title of the thesis: <i>Research on influence of technology process on heavy metals containment in bakery products</i> 2005 PhD Eng., Lublin University of Technology, Mechanical Engineering Faculty, Title of thesis: <i>Analysis of nonlinear vibrations in metal element turning</i>
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2. PERSONAL CAREER

In 1993 I started to study at Faculty of Mechanical Engineering of Lublin University of Technology. After 3rd year I followed an individual course of studies because of my high personal achievements. In 1998 I graduated with a very good result obtaining MSc degree in Mechanics and Mechanical Engineering. Simultaneously I started postgraduate study in the

field of management and marketing at Centre of Managers Education in Lublin (and LUT). I graduated in 1999. Just after graduating from the LUT I started working in Department of Applied Mechanics at Lublin University of Technology taking a position of assistant.

Before I defended my PHD thesis I had co-authored eight papers published in refereed scientific journals (II.A.4-II.A.7, II.C.14-II.C.17). Four of them were published in periodicals covered by the Journal Citation Report (JCR, II.A.4-II.A.7). The papers were devoted to experimental and theoretical research on dynamical phenomena in cutting processes which were described by nonlinear models with the Rayleigh self-excitation. This topic was strictly connected with a PhD grant entitled *Analysis of nonlinear vibrations in metal element turning* (II.H.7) and project no 126/E-361/SPUB/COST/T-7/DZ42/99 *Nonlinear dynamics in mechanical processing* (II.H.8).

My experience was enriched during seven scientific conferences (II.J.8-II.J.11, III.B.10-III.B.13) where I presented results of my research (in English, II.J.8, II.J.10, II.J.11, III.B.12). Since 1999 I have been a member of the Polish Society of Theoretical and Applied Mechanics (PTMTS) and The Society of Engineers and Polish Mechanics (SIMP). Through five cadencies (2001-2010) I was a treasurer in Lublin branch of the PTMTS. Before PhD I attended two research projects (II.H.7, II.H.8) and I was in Faculté Polytechnique de Mons (Belgia, III.L.1) in order to get professional experience. In 2004 I was awarded by the Rector of the LUT for my scientific achievements (II.I.4). Moreover, I obtained a scholarship of Professor Kazimierz Lutek (II.I.3).

Working as an assistant I started PhD studies at the Mechanical Engineering Faculty of LUT. I defended my PhD thesis "*Analysis of nonlinear vibrations in metal element turning*" in the field of Construction and Machine Maintenance in 2005. My thesis, supervised by prof. Jerzy Warminski, was distinguished by the Council of Mechanical Engineering Faculty. . In the thesis I pointed out a significant influence of dry friction between the tool and the workpiece.

After the defence of my PhD I was employed as an assistant professor in the Department of Applied Mechanics of the LUT, where I have been working up to the moment. I have continued the previous research. Moreover, I widened my research methods and undertook some new topics focused on milling process of new materials used in aviation industry. My interest of such materials was connected with projects: "*Modern material technologies in aerospace industry*" financed from the European Regional Development Fund

in the Operational Programme - Innovative Economy (II.H.4) and *"Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification"* no 65/6 PR UE/2005/7 (II.H.6) and also „*Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure - CEMCAST*“, no FP7 – 245479 (II.H.3).

An analysis of signals coming from non-linear, discontinuous and sometimes also stochastic systems was a new challenge therefore, it was necessary to get deeper knowledge and skills. As results I published some papers pointed out in section 3, as my personal scientific achievements. These articles concern new methods of signals analysing obtained from nonlinear dynamical systems, the methods of identification of self-excited chatter vibrations in cutting processes and modelling of milling process. Looking for efficient way to signals analysis I found special technique basing on recurrence, multiscale entropy and wavelets. That was used both for classical materials and polymer matrix composites reinforced carbon fibres.

At the same time I got involved in cooperation with Medical University of Lublin creating the first team in Poland, which dealt with research of human middle ear vibrations. As a result of the scientific effort, the three projects were carried out (II.H.2, II.H.5, III.F.1). I administered one of them (III.F.1). As a consequence seven papers were published. They concerned an analysis and modelling of ossicular chain vibrations in case of the intact, injured (damaged) and reconstructed middle ear. I was the first who revealed irregular vibrations of human middle ear. It is possible for some specific external excitation. Moreover, I proposed using recurrence plot technique to enrich classical methods of signal analysis. This technique allowed investigating phenomena taking place in middle deeper and more accurately ear than classical methods used in otolaryngology. The problem of human ossicular chain dynamics was supplementary field of my professional activity, which was described in section 4.II.

Since 2007 I have appointed to XV Commission of Nonlinear Sciences in Polish Academy of Sciences (PAS), branch in Lublin. Furthermore, I was a member of Dynamical Systems Section in Mechanics Committee of PAS from 2007 to 2010. Since 2012 I have been an expert of National Science Centre in Division of Exact and Technical Sciences (ST8B). I was a chairman during experts meetings sessions of "Sonata" and "Preludium" competition no 5.

After defence of my PhD I have published 13 papers in periodicals covered by the JCR (I.B.1-I.B.3, I.B.5--I.B.11, II.A.1-II.A.3) and 18 in other reviewed scientific journals (I.B.4, I.B.12-I.B.14, II.C.1-II.C.13). I participated in 16 international conferences, where I gave presentations (II.J.1-II.J.7, III.B.1-III.B.9). What is more, on the conference in Metz I chaired a session (II.J.2).

I also improved my knowledge and skills during my 1-month stays in the University of Aberdeen (3 times, III.L.2-III.L.4), where I collaborated with the scientists gathered in the Centre for Applied Dynamics Research (CADR) in the field of nonlinear dynamics. Moreover, my qualifications were increased through participation in nine national and international projects (II.H.1-II.H.8, III.F.1). I have managed two of them (II.H.1, III.F.1). I reviewed 16 scientific papers (III.P.1-III.P.7).

My professional activity was awarded in 2006 and 2011 by the Rector of LUT who gave me a scientific prize of the second and of the third order (II.I.1, II.I.2). In 2011 I received the Bronze Badge of the SIMP (III.D.1).

All of my professional achievements consist of 39 reviewed papers; 17 of them are in journals placed in the Journal Citation Reports. My total Impact Factor IF=16.746 (2011). My papers are cited 73 times according to the Google Scholar (Publish or Perish) and 29 in agreement with the Web of Science (WoS). But one should realize that the WoS does not contain all journals which have Impact Factor. Section 4 contains more comprehensive description of my achievements, whereas in section 5 I have shown a brief summary.

Special place in my professional life takes didactic. I have had lectures, calculus and laboratory classes in Mechanics, Mechanical Vibrations, and Strength of Materials, Biomechanics and Physics. I am a co-author of student's books entitled „*Laboratory of materials strength*” and „*Laboratory of Machine Dynamics*”. I have written teaching programme of Biomechanics and have organized the Laboratory of Biomechanics. Moreover, I take care of MSc and PhD students (Andrzej Weremczuk, III.K.1).

I also took part in organization of conferences and workshops in Lublin *Euromech Colloquium 498* in Kazimierz, (2008, III.B.9); *Nonlinear Dynamic Phenomena in Mechanical, Aerospace, and Civil Engineering*, 2012r). Within the period of 2005-2008 I was a member of the Council of Mechanical Engineering Faculty. Nowadays I attend to the works of the Faculty Commission for Scientific Research and Staff Development.

3. DESCRIPTION OF SCIENTIFIC ACHIEVEMENT

My scientific achievement starting from art. 16 ust. 2 act dated March 14, 2003 „Ustawa o stopniach naukowych i tytule naukowym oraz o stopniach i tytule w zakresie sztuki” concerns nonlinear mechanics of cutting process especially material used in aviation industry, such as superalloys and composites. Series of publications constituting a scientific achievement is entitled „***Nonlinear dynamics of cutting process–analysis and modelling***”.

1. **Rusinek R.**, Warmiński J, Attractor reconstruction of self-excited mechanical systems, *Chaos, Solitons & Fractals*, 2009 vol.40: 172-182.
IF2009=3,315, my contribution 80%
2. **Rusinek R.** Cutting process of composite materials: An experimental study. *International Journal of Non-Linear Mechanics*, 2010, vol.45: 458-462.
IF2010=1,388
3. Litak G., Syta A., **Rusinek R.**: Dynamical changes during composite milling: recurrence and multiscale entropy analysis. *Int. Journal of Advanced Manufacturing Technology*, 2011, vol.56: 445-453.
IF2011=1,103, my contribution 40%
4. **Rusinek R.**, Kęćik K., Warmiński J.: Dynamics of composite material cutting. *Advances in Manufacturing Science and Technology*, 2011, vol.35(3): 31-37.
my contribution 60%
5. **Rusinek R.** Vibrations In Cutting Process Of Titanium Alloy. *Maintenance And Reliability* 2010, vol.3: 48-55.
IF2010=0,319
6. **Rusinek R.** Stability criterion for aluminium alloy milling expressed by recurrence plot measures, *Proceedings of the Institution of Mechanical Engineers, Part B, Journal of Engineering Manufacture*, doi: 10.1177/0954405412462779
IF2011=0,725
7. Kęćik K., **Rusinek R.**, Warmiński J.: Stability Lobes Analysis of Nickel Superalloys Milling. *International Journal of Bifurcation and Chaos*, 2011, vol.21(10): 2943-2954,
IF2011=0,814, my contribution 40%
8. Litak G., Kęćik K., **Rusinek R.**: Cutting Force Response in Milling of Inconel: Analysis by Wavelet and Hilbert - Huang transforms. *Latin American Journal of Solids and Structures* (w druku)
IF2011=0,579, my contribution 30%
9. Litak G., **Rusinek R.**: Vibrations in stainless steel turning: multifractal and wavelet approaches. *Journal Of Vibroengineering*, 2011, vol.13(1): 102-108. ISSN 1392-8716.

IF2011=0,346, my contribution 60%

10. Litak G., **Rusinek R.**: "Dynamics of a Stainless Steel Turning Process by Statistical and Recurrence Analyses", *Meccanica*, 2012, vol.47: 1517-1526.

IF2011=1,558, my contribution 60%

11. Kęćik K., **Rusinek R.**, Warmiński J.: Modeling of high-speed milling process with frictional effect. *Journal of Multi-body Dynamics, Proceedings of the Institution of Mechanical Engineers Part K*, doi: 10.1177/ 1464419312458636

IF2011=0,566, my contribution 40%

12. **Rusinek R.**: Chatter In Milling of Composites: Simulations And Diagnostic. *Journal of Machine Engineering*, 2010, vol.10(3): 30-36.

13. **Rusinek R.**, Warmiński J.: Chatter in Cutting Processes. *Journal of Machine Engineering*, 2009, vol.9(1): 41-49.

my contribution 80%

14. **Rusinek, R.**, Weremczuk, A., and Warmiński, J., „Regenerative Model of cutting process with nonlinear Duffing oscillator" *Mechanics and Mechanical Engineering*, 2011, vol. 15(4): 129-143.

my contribution 70%

The scientific aim of the mentioned publications is development of efficient method of real signals analysis from cutting process and also building of the mathematical model which let one explain substantial phenomena during machining. Adequate methods of analysis let us forecast and avoid self-excited chatter vibrations during turning and milling of materials used in the aviation industry which are hard to machining e.g. stainless steel, composites materials, nickel (Inconel) and titanium alloys. The procedures of instability detection in experimental signals related to the bifurcation of trivial solution lead to harmful chatter vibrations and are known and commonly used in case of linear systems. However, in practice a cutting process is nonlinear and discontinuous therefore, the classical methods of analysis fail. In the literature one can find a lot of examples which claim that unstable regions (lobes) are not fully acknowledged experimentally. Very often, it is caused by incorrect assumption about the system linearity, continuity and sometimes by stochastic element as well. That explains my interest of the problem which is also continuation of PhD thesis.

The first of mentioned above papers [1] focuses on time series analysis of the systems with nonlinearities, discontinuities and dry friction. I have shown that only one signal is not sufficient to describe phenomena with the help of delayed coordinates. That

statement has been written by creators of the method. There is a special class of phenomena which are described by discontinuous differential equations (e.g. cutting process) therefore the analysis of only one representative time series gives too poor and incomplete view of the phenomenon. As a result, mistakes in reconstructed phase space for system with “stick-slip” exist. Inspired by the results I have published series of papers [2-10] devoted to methods of instability estimation in cutting processes of hard machining materials, such as: epoxide-polymer matrix composites reinforced carbon fibres (carbon fibre reinforced polymer CFRP), titanium, nickel and alumina alloys. Consecutively I have developed method of observation using besides reconstructed attractors, also the recurrence plot technique [2,3,5,7], the recurrence quantification analysis (RQA) [4,7,10], wavelet and multifractal analysis [8,9], multi-scale entropy [3] and the Hilbert – Huang transform [8]. Using presented methods I have pointed out that a change of cutting parameters (depth, feed and velocity) generates the change of trajectory topology and recurrence plots [2,5]. The outcomes make me develop procedure of chatter region identification with the help of index obtained from recurrence quantifications analysis. The indexes have been used for cutting process of the new composites material [2,3,4] and super-alloys applied in aviation industry [6,7,10]. In the others papers containing the results of experimental research I have used recurrence [10], wavelet [8,9] and multi-fractal [9] analysis as well multiscale entropy [3] and Hilbert – Huang transform [8]. That brings me to following conclusions:

- An increase of cutting depth leads to cutting force fluctuations that is stronger excitation than classical regeneration effect. „Stick – slip” effect accompanies this phenomenon as well.
- On the basis on wavelet analysis and the Hilbert – Huang transform it is proved that the Hopf’s bifurcation exists during transition from stable to unstable cutting regions. This bifurcation leads to harmonic chatter vibrations [8]. However, further increase of cutting depth generates irregular or even chaotic behaviours [10].
- Higher harmonics are observable in the cutting force experimental signal that proves mutual interactions between the structural and frictional nonlinearities with regenerative effect [8].

- During milling of CFRP, intermittency phenomenon is found out with the help of multi-fractal and wavelet analysis.

Experimental investigations are completed by modelling of the cutting process. My models take into account the effect of regeneration by displacement and dry friction simultaneously [1,11-14]. The non-linear model of dry friction is described by the self-excited Rayleigh's term that is my own contribution into cutting dynamics. This self-excitation together with classical regenerative effect influences the system dynamics [11,13].

On the one hand the frictional effect is a source of instabilities at small cutting velocities but on the other hand for relatively big velocities the amplitude of chatter vibrations is limited to some value resulting from the limit cycle. Taking into account only frictional effect as a cause of self-excited vibrations, I have revealed that besides the Hopf's bifurcation which exists as a consequence of increasing cutting resistance, also inverse Hopf's bifurcation can appear when relative velocities between the tool and the workpiece rises. Moreover, the secondary Hopf's bifurcation can exist as a result of the spindle speed rise. In case of flexible elements machining with relatively small velocities, quasi – harmonic motion undergoes into chaos that is the effect of centrifugal force coming from rotating element [13].

Recently, I have focused on the nonlinear Duffing's oscillator with time delayed displacement [14] which is also an example of cutting model with structural nonlinearity. Among the results of my investigations, interesting bifurcations of solutions appear when the amplitude of time delay (regenerative effect) increases, but the bifurcation point depends on the initial conditions. The stability loss of the periodic solution as a consequence of the time delay (spindle speed) is another effect noteworthy. Thus, the amplitude and value of time delay strongly influence system dynamics therefore should be applied in intelligent control systems in order to avoid chatter vibrations. This matter is the target of my future work but some results are just published in the papers [II.C.4, II.C.5].

4. FULL LIST OF PUBLICATION AND ACHIEVEMENTS

I. List of publications constituting a scientific achievement

A) Title of scientific achievement:

Nonlinear dynamics of cutting process—analysis and modelling

B) Publications constituting a scientific achievement

- I.B.1. **Rusinek R.**, Warmiński J, Attractor reconstruction of self-excited mechanical systems, *Chaos, Solitons & Fractals*, 2009, 40: 172-182. **IF2009=3,315**

My contribution consists in:

- planning of experiment strategy, carrying out of experimental research in the laboratory according to scheme presented in tab.1,
- choose and configuration of experimental set up shown in Fig.1,
- signal analysis with the help of delayed coordinates (method of delays) and graphically presented the results in Fig.2 and 3,
- numerical calculations and simulations performed using model shown in Fig.4, the results analysis in original and reconstructed phase space (method of delay)
- preparation of sections 1-5 and interpretation of the outcomes.

I estimate my contribution is 80%

- I.B.2. **Rusinek R.** Cutting process of composite materials: An experimental study. *International Journal of Non-Linear Mechanics*, 2010, 45: 458-462. **IF2010=1,388**

- I.B.3. Litak G., Syta A., **Rusinek R.**: Dynamical changes during composite milling: recurrence and multiscale entropy analysis. *Int. Journal of Advanced Manufacturing Technology*, 2011, vol.56: 445-453. **IF2011=1,103**

My contribution consists in:

- planning and carrying out experimental investigations on the CNC milling machine,
- selection and configuration of experimental set up shown in Fig.1, elaboration of cutting conditions of CFRP,
- force signal analysis presented in Fig.2 with the help of recurrence analysis shown in Fig.3,
- interpretation of recurrence analysis and recurrence quantification analysis (RQA) placed in Tab.1,
- elaboration of final remarks and preliminary version of the paper.

I estimate my contribution is 40%

- I.B.4. **Rusinek R.**, Kęćik K., Warmiński J.: Dynamics of composite material cutting. *Advances in Manufacturing Science and Technology*, 2011, vol. 35(3): 31-37.

My contribution consists in:

- elaboration of experiment strategy, carrying out of experimental research on milling of CFRP with changeable cutting speed and depth,
- carrying out of recurrence quantification analysis (RQA), the results are presented in Fig.4,
- preparing Fig.5 and 6 which present unstable regions during composite milling,
- interpreting of the experimental results,
- preparing preliminary version of the manuscript and conclusions.

I estimate my contribution is 70%

I.B.5. **Rusinek R.** Vibrations In Cutting Process Of Titanium Alloy. *Maintenance And Reliability*, 2010, vol.3: 48-55. **IF2010=0,319**

I.B.6. **Rusinek R.** Stability criterion for aluminium alloy milling expressed by recurrence plot measures, *Proceedings of the Institution of Mechanical Engineers, Part B, Journal of Engineering Manufacture*, doi: 10.1177/0954405412462779 **IF2011=0,725**

I.B.7. Kęcik K., **Rusinek R.**, Warmiński J.: Stability Lobes Analysis of Nickel Superalloys Milling. *International Journal of Bifurcation and Chaos*, 2011, vol.21(10):2943-2954. **IF2011=0,814**

My contribution consists in:

- planning of experiment strategy, carrying out of experimental research in the laboratory (milling of nickel alloy - Inconel),
- calculations of stable regions during milling process depicted in Fig.2,
- force signals analysis with the help of Hurst and Lyapunov exponents (Fig.3 i 4),
- analysis of measurement signals by means of recurrence plots technique and recurrence quantification analysis (RQA), depicted in Fig. 11, 12 and in Tab.1,
- interpretation of the investigation results and elaboration of conclusions,
- preparation of sections 4, 6,7.

I estimate my contribution is 50%

I.B.8. Litak G., Kęcik K., **Rusinek R.**: Cutting Force Response in Milling of Inconel: Analysis by Wavelet and Hilbert - Huang transforms. *Latin American Journal of Solids and Structures* (accepted) **IF2011=0,579**

My contribution consists in:

- planning of experiment strategy, carrying out of experimental research on milling of Inconel with increasing depth of cut,
- interpretation of the experimental results, outcomes of wavelet analysis and Hilbert-Huang transform,
- formulating of summary section.

I estimate my contribution is 30%

- I.B.9. Litak G., **Rusinek R.**: Vibrations in stainless steel turning: multifractal and wavelet approaches. *Journal Of Vibroengineering*, 2011, vol.13(1): 102-108. ISSN 1392-8716. **IF2011=0,346,**

My contribution consists in:

- elaboration of the method of chatter vibrations identification and domain of study
- planning of experiments, carrying out experimental investigations on the lathe – turning process of stainless steel,
- force signal analysis presented in Fig.1, and statistical analysis of the results described in Tab.1,
- interpretation of multifractal, wavelet and statistical analyses presented in Fig.2-3 and Tab.1,
- elaboration of final remarks and preliminary version of the paper.

I estimate my contribution is 60%

- I.B.10. Litak G., **Rusinek R.**: “Dynamics of a Stainless Steel Turning Process by Statistical and Recurrence Analyses”, *Meccanica*, 2012, vol.47: 1517-1526. **IF2011=1,558**

My contribution consists in:

- planning of experiment strategy, carrying out of experimental research on turning of stainless steel,
- preparing sections 3 and 4 of the paper, doing calculations to analyse cutting forces on the basis of recurrence plots technique (rys.7),
- statistical analysis of recurrence shown in Tab.2,
- interpreting of the results, preparing of final remarks.

I estimate my contribution is 60%

- I.B.11. Kęcik K., **Rusinek R.**, Warmiński J.: Modeling of high-speed milling process with frictional effect. *Journal of Multi-body Dynamics, Proceedings of the Institution of Mechanical Engineers Part K*, doi: 10.1177/1464419312458636 **IF2011=0,566**

My contribution consists in:

- elaboration a one degree of freedom, nonlinear model of milling with frictional and regenerative effect,
- Identification of elastic and damping properties of a chuck-tool system, and defining stability regions shown in Fig.4,
- carrying out of numerical simulations presented in Fig.3 and 10,
- interpretation of the numerical results and elaboration of conclusions
- preparing sections: „Model of milling...” and „Numerical and experimental results”

I estimate my contribution is 50%

- I.B.12. **Rusinek R.**: Chatter In Milling Of Composites: Simulations And Diagnostic. *Journal of Machine Engineering*, 2010, vol.10(3): 30-36.

- I.B.13. **Rusinek R.**, Warmiński J.: Chatter in Cutting Processes. *Journal of Machine*

Engineering, 2009, vol.9 (1): 41-49.

My contribution consists in:

- elaboration of nonlinear and discontinuous model of turning process with frictional effect (presented in Fig.3),
- carrying out of analytical calculations with the help of multiple scale method,
- carrying out of numerical simulations of nonlinear model with frictional and regenerative chatter (Fig.5),
- preparing bifurcation diagrams (Fig.6) and interpreting of investigation research,
- preparing preliminary version of the manuscript.

I estimate my contribution is 80%

- I.B.14. **Rusinek, R.**, Weremczuk, A., and Warmiński, J., „Regenerative Model of cutting process with nonlinear Duffing oscillator" *Mechanics and Mechanical Engineering*, 2011, vol.15(4):129:143.

My contribution consists in:

- building of model of cutting process with Duffing's nonlinearity and time delayed displacement. The model is presented in Fig.1 and described by delay differential equation of motion (1),
- carrying out of the analysis of modulation equations obtained as a results of solving equation (1) by the multiple scales method,
- preparing numerical simulations and bifurcation analysis presented in Fig.2-8,
- interpreting of the research outcomes and preparing the final version of manuscript.

I estimate my contribution is 70%

II. List of scientific achievements, not mentioned in section I

Scientific publications and reports presented here concern the cutting process and my additional scientific activity connected with dynamics of a human middle ear. Analysis and modelling of ossicular chain are conducted in cooperation with Medical University of Lublin. Our team, as a first in Poland, has built experimental set up to measure vibrations of ossicular chain with the help of Laser Doppler Vibrometer (LDV) [II.C.10,II.C.12]. On the basis on our experimental research I have proposed extending the classical method of hearing evaluation. Classically, a frequency response function is used in otolaryngology but this method does not give comprehensive knowledge of the middle ear dynamics. Therefore, I have introduced the delay coordinates method and recurrence plots technique [II.A.2,II.C.3].

On the grounds of the reconstructed attractors in phase space, the Lyapunov and Hurst exponents, and recurrence quantification analysis I have exhibited that ossicles vibrations can be irregular in case of the middle ear is pathological or damaged. From practical point of view, measure of recurrence plots e.g. the *laminarity*, the *divergence* or the *tripping time* can be applied to estimate a correctness of the hearing loss treatment.

To complete my research I have developed the mathematical model of middle ear vibrations with three and six degrees of freedom [II.C.2,II.C.6,II.C.1]. That let me explain an influence of the joints and the ligaments stiffness on vibrations frequencies and modes. As an effect I have obtained the nonlinear model which allows analysing otosclerosis [II.C.1]. With the aid of the model, different bifurcation scenarios are possible depending on the excitation amplitude. I have observed the subcritical bifurcation and a jump of the vibration amplitude which deteriorates hearing caused by a rigor of the annular ligament. Summing up, I have pointed out nonlinear models of the human middle ear much better describe its complex dynamics and let explain some atypical behaviour.

A) Publications from Journal Citation Reports

After PhD

- II.A.1. Sen A.K., Litak G., Syta A., **Rusinek R.**, Intermittency and Multiscale Dynamics in Milling of Fiber Reinforced Composites, *Meccanica*, 2012, doi: 10.1007/s11012-012-9631-5 **IF2011=1,558**

My contribution consists in: planning of experiment strategy, carrying out of experimental research on milling of CFRP, interpretation of the experimental results and outcomes of wavelet and multi-fractal analysis. I estimate my contribution is 30%

- II.A.2. **Rusinek R.**, Szymański M., Warmiński J., Zadrożniak M., Morshed K.: Vibrations in the Human Middle Ear. *Medical Science Monitor* 2011, vol.17(12):372-376. **IF2011=1,699**

My contribution consists in: carrying out of experimental research on ossicles vibrations with the help of LDV, signal analysis with the help of the method of delays, recurrence plots, Lyapunowa and Hurst exponents, calculating of frequency response function. I estimate my contribution is 80%

- II.A.3. Litak G., Kamiński T., **Rusinek R.**, Czarnigowski J., Wendeker M.: Patterns in the

combustion process in a spark ignition engine. *Chaos, Solitons & Fractals*, 2008, 35: 578-585

IF2011=1,222

My contribution consists in: signal analysis with the help of the method of delays, interpreting of the results. I estimate my contribution is 20%

Before PhD

- II.A.4. Litak G., **Rusinek R.**, Teter A.: Nonlinear Analysis of Experimental Time Series of a Straight Turning Process. *Meccanica*, 2004, vol.39:105-112

IF2011=1,558

My contribution consists in: planning of experiment strategy, carrying out of experimental research and force signal analysis. I estimate my contribution is 30%

- II.A.5. **Rusinek R.**, Warmiński J.: Cutting of non-circle cross section elements. *Maintenance And Reliability*, 2004, vol.4:28-31.

IF2011=0,333

My contribution consists in: planning of experiment strategy, carrying out of experimental research and force signal analysis in the domain of time and frequencies. I estimate my contribution is 80 %

- II.A.6. Lipski J., Litak G., **Rusinek R.**, Szabelski K., Teter A., Warmiński J., Zaleski K.: Surface quality of a work material's influence on the vibrations of the cutting process. *Journal of Sound and Vibration*, 2002, vol.252(4): 729-737.

IF2011=1,588

My contribution consists in: carrying out of experimental research and force signal analysis, building of mathematical model of cutting. I estimate my contribution is 30%

- II.A.7. **Rusinek R.**, Warmiński J., Szabelski K., Teter A., Litak G., Lipski J., Zaleski K.: An influence of turning parameters on surface quality. *Maintenance And Reliability*, 2001, vol.5(12): 41-42.

IF2011=0,333

My contribution consists in: building of mathematical and numerical model of turning process, carrying out of numerical simulations and results interpreting. I estimate my contribution is 60%

B) Inventions and patents

-

C) Monographs and publications in journals outside JCR (II.A):

After PhD

- II.C.1. **Rusinek R.**, Warmiński J., Zadrożniak M., Szymanski M., "Nonlinear Approach to Modelling of Otosclerosis in a Human Middle Ear," *Differential Equations and Dynamical Systems*, 2012. Doi: 10.1007/s12591-012-0122

My contribution consists in: developing of mathematical model of the human middle ear, carrying out of stiffness analysis of ligaments and joints. *I estimate my contribution is 50%*

- II.C.2. **Rusinek R.**, "Middle Ear Protheses. Modelling and Simulations," *Vibrations in Physical Systems*, 2012, vol.25: 341-346.

- II.C.3. **Rusinek R.**, Warmiński J., Zadrożniak M., Szymanski M., "Middle ear reconstruction estimated by recurrence plot technique," *Theoretical & Applied Mechanics Letters*, 2012, vol.2: 043012.

My contribution consists in: carrying out of experimental research on intact and reconstructed ossicles with the help of LDV, signal analysis with the help of the method of delays, recurrence plots and recurrence quantification analysis. *I estimate my contribution is 80%*

- II.C.4. Kecik K., **Rusinek R.**, Warminski J., Weremczuk, A., "Chatter control in the milling process of composite materials," *Journal of Physics: Conference Series*, 2012, vol.382: 012012.

My contribution consists in: elaborating of milling model of composites material, performing numerical simulations and drawing conclusions. *I estimate my contribution is 30 %*

- II.C.5. **Rusinek R.**, Kecik K., Warminski J., Weremczuk A., "Dynamic model of cutting process with modulated spindle speed," *AIP Conference Proceedings*, 2012, vol.1493(1): 805-809.

My contribution consists in: elaborating of milling model with modulated spindle speed, of composites material, performing numerical simulations and drawing conclusions. *I estimate my contribution is 80%*

- II.C.6. Samborski S., **Rusinek R.**, Szymański M., An Influence of Auditory Chain Components Stiffness on Vibrations Characteristics Measured by a Finite-Element Model of the Middle Ear Structure, *Vibrations in Physical Systems*, 2012, vol.25: 347-352.

My contribution consists in: preparing of 3D model of ossicular chain for Abaqus, interpreting the results. *I estimate my contribution is 30%*

- II.C.7. **Rusinek R.**, Warmiński J., Szymański M, Zadrożniak M., Morshed K.: Modelling of Sound Transmission in Human Middle Ear. *Journal of International Advanced Otolaryngology*. 2011, vol.7(3) Supplement 2.

My contribution consists in: carrying out of experimental research and numerical simulations on the basis of the mathematical model of middle ear. I estimate my contribution is 70%

- II.C.8. Szymański M, **Rusinek R.**, Zadrożniak M., Warmiński J., Morshed K.: The Influence of Cochleostomy and Cochlear Implant Electrode on Stapes and Round Window Vibration. *Journal of International Advanced Otology*. 2011, vol.7(3) Supplement 2.

My contribution consists in: carrying out of experimental research. I estimate my contribution is 20%

- II.C.9. Kęcik K., **Rusinek R.**, Warmiński J.: Dynamical analysis of milling process with various radial depth of cut. *Mechanical Engineering and production management (Budowa maszyn i zarządzanie produkcją)*, 2011, vol.2(16): 69-81.

My contribution consists in: planning and carrying out of experimental research, analysing forces signal in reconstruction phase space. I estimate my contribution is 40%

- II.C.10. **Rusinek R.**, Warmiński J., Szymański M., Zadrożniak M.: Analysis of Human Ear Ossicles Vibrations. *Vibrations in Physical Systems*, 2010, 24: 343-348.

My contribution consists in: carrying out of experimental research on ossicles with titanium prosthesis with the help of LDV, signal analysis with the help of the method of delays, recurrence plots, Lyapunowa and Hurst exponents, calculating of frequency response function. I estimate my contribution is 40%

- II.C.11. **Rusinek R.**, Warmiński J.: Inspection of cutting methods of titanium alloys used in aviation industry (Przegląd Metod Obróbki Stopów Tytanu Stosowanych w Przemysle Lotniczym). *Journal of Machine Engineering*, 2009, vol.4(4): 113-123.

My contribution consists in: preparing state of the art, performing experimental investigations, interpreting results and concluding. I estimate my contribution is 80%

- II.C.12. Szymański M, **Rusinek R.**, Zadrożniak M., Warmiński J., Morshed K.: Vibrations of tympanic membrane measured by Laser Doppler Vibrometer. *Otolaryngol. Pol.*, 2009, vol.63 (2): 180-183.

My contribution consists in: carrying out of experimental research on tympanic membrane with the help of LDV, signal analysis in frequency domain as FRF (frequency response function). I estimate my contribution is 40%

- II.C.13. **Rusinek R.**, Warmiński J., Szabelski K.: *Nonlinear vibrations in metal cutting process*, IZT Lublin 2006, ISBN: 83-88691-38-4.

My contribution consists in: planning and carrying out of experimental research,

force signal analysis, building of mathematical model of cutting process, numerical and analytical calculations. *I estimate my contribution is 80%*

Before PhD

- II.C.14. **Rusinek R.:** Non-circular cross-sectional elements turning process– experimental research. *Problemy Techniki*. 2004, vol.2:147-152.
- II.C.15. **Rusinek R., Szabelski K., Warmiński J.:** Influence of the workpiece profile on the self-excited vibrations in a metal turning process. W: Radons G., Neugebauer R., (ed.) *Nonlinear Dynamics of Production Systems*. Weinheim, Wiley-VCH, 2004, 153-167.

My contribution consists in: elaboration of second pass turning model, doing geometrical and dynamical analysis. *I estimate my contribution is 80%*

- II.C.16. **Rusinek R., Szabelski K., Warmiński J.:** Vibration analysis of two-dimensional model of metal turning process. W: Cartmell M.P. (ed.) *Modern Practice in Stress and Vibration Analysis*, vol. 440-441, Glasgow, 9.IX.2003-11.IX.2003. Trans Tech Publications, Zurich-Uetikon, 2003, 520-526.

My contribution consists in: elaboration of 2 dof (degrees of freedom) turning model, carrying out of numerical analysis. *I estimate my contribution is 80%*

- II.C.17. **Rusinek R., Warmiński J.:** Vibrations of Rayleigh-Mathieu Oscillator with quadratic elasticity characteristic. *Folia Societatis Scientiarum Lublinensis*, 2000, vol.9: 142-151.

My contribution consists in: carrying out of analytical and numerical calculations of differential equations which describe Rayleigh-Mathieu oscillator. *I estimate my contribution is 60%*

D) Scientific publications, documentation of research and development

Reports of scientific research done in the frame of the project "Modern material technologies in aerospace industry", No. POIG.01.01.02-00-015/08-00. The project supported in the Operational Programme-Innovative Economy.

- II.D.1. **Rusinek R.** Analysis of titanium alloy (TiAl6V4) machinability - experimental investigations. Modern methods of titanium alloys cutting and signal analysis. Report 1/2009
- II.D.2. Warmiński J., Kęcik K., **Rusinek R.**, Pawłowska B., Stability analysis of milling process of titanium and nickel alloys basing on recurrence analysis. Report 1/2010.

My contribution consists in: developing of methods based on recurrence plots technique to estimate milling stability. *I estimate my contribution is 35%*

- II.D.3. **Rusinek R.**, Pawłowska B. Elaboration of indexes stability of superalloys used in aviation industry. Report 2/2010,

My contribution consists in: introduction of new stability indexes such as quantifiers of RP. I estimate my contribution is 85%

- II.D.4. Warmiński J., **Rusinek R.**, Pawłowska B., Developing of regenerative model of milling for composites materials. Estimation of dry friction influence on milling stability – theoretical backgrounds and numerical investigations. Report 1/2011,

My contribution consists in: creating of regenerative model of CFRP milling, carrying out of numerical investigations. I estimate my contribution is 45%

- II.D.5. Warmiński J., **Rusinek R.**, Kęcik K., Pawłowska B., Piekarczyk A., Królicki A. Numerical investigations and experimental verification of superalloys cutting. Report 2/2011,

My contribution consists in: carrying out of stability analysis on the basis of regenerative and frictional model. I estimate my contribution is 30%

- II.D.6. Warmiński J., **Rusinek R.**, Pawłowska B., Creating computer program for stability analysis of cutting process on the basis on 1 and 2 degrees of freedom system. Report 1/1012

My contribution consists in: analytical solution of the problem with the help of Laplace transform, developing of numerical code with GUI. I estimate my contribution is 80%

- II.D.7. Warmiński J., Kęcik K., **Rusinek R.**, Weremczuk A., Pawłowska B., Analysis of possibility of chatter suppression during milling of classical and composites material. Report 2/2012,

My contribution consists in: developing of spindle speed variation method for regenerative and frictional chatter, performing of numerical simulations. I estimate my contribution is 30%

- II.D.8. **Rusinek R.**, Assumption for cutting model of alloys: Al and Mg. Report 1/2010.

- II.D.9. **Rusinek R.**, Stability criterion of end milling in the aspect of efficiency. Report 2/2010

- II.D.10. **Rusinek R.**, Zaleski K., Experimental verification of stability regions in aluminum alloy milling. Report 1/2011.

My contribution consists in: planning and carrying out of experimental research, force signal analysis, verification of stability lobes diagrams. I estimate my contribution is 40%

II.D.11. **Rusinek R.**, Zaleski K., Experimental research on aluminium alloys stability at various chip thickness. Raport 1/2012.

My contribution consists in: analysis of cutting forces at various chip thickness, making of stability lob diagram. I estimate my contribution is 50%

II.D.12. **Rusinek R.**, Zaleski K., An influence of chip thickness on cutting forces. Raport 2/2012.

My contribution consists in: carrying out of experimental research. I estimate my contribution is 40%

E) Total impact factor according to Journal Citation Reports (JCR, in the year of publication) : 16,066

F) Citations according to Web of Science (WoS): 29 (23 without self-citation)
73 (according to Publish or Perish and GoogleScholar)

G) Hirsch Index according to Web of Science (WoS): 3
(5 according to Publish or Perish and GoogleScholar)

H) Scientific projects

II.H.1. **2011-2014** „Bifurcations and chaos in mathematical models of cutting processes”
Project NCN nr 2011/01/B/ST8/07504 **(head)**

II.H.2. **2011-2013** „Influence of cochlear implant electrode on middle ear and cochlear mechanics analysed with the use of Laser Doppler Vibrometer” Project MNiSW N N403 283440 **(investigator)**

II.H.3. **2010-2013** „Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure - CEMCAST”, Grant agreement no.: FP7 – 245479 (cordinated by prof. T. Sadowski). **(investigator)**

II.H.4. **2008-2013** „Modern material technologies in aerospace industry” Operational Programme - Innovative Economy (IE OP) financed from the European Regional Development Fund. Project no POIG.0101.02-00-015/08 **(investigator)**

II.H.5. **2007-2010** „Factor influencing optimal ossicular reconstruction evaluated on the basis of intact and reconstructed ossicular chain with the use of Laser Doppler Vibrometer”.
Project MNiSW N403 065 32/3451 **(investigator)**

II.H.6. **2005-2009** „Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification”
Project no 65/6 PR UE/2005/7 (ToK) **(investigator)**

- II.H.7. **2003-2005** „Analysis of nonlinear vibrations in turning process”
PhD grant KBN no 5T07C 017 24
- II.H.8. **1999-2001** “Nonlinear dynamics in mechanical processing”,
KBN no 126/E-361/SPUB/COST/T-7/DZ42/99 **(investigator)**

I) Awards for scientific activity

- II.I.1. Second order Rector’s team award, Lublin University of Technology 2011
- II.I.2. Third order Rector’s team award, Lublin University of Technology 2006
- II.I.3. Scholarship of Prof. Kazimierz Lutek, Lublin University of Technology 2004,
- II.I.4. Second order Rector’s team award, Lublin University of Technology 2004

J) Thematic conference presentations

- II.J.1. 14-17.03.2011 Wrocław University of Technology, Karpacz, Poland
Conference: *Model Based Manufacturing*
Presentation: "*Chatter In Milling Of Composites: Simulations And Diagnostic* "
Author(s): **Rusinek R.**
- II.J.2. 08-10.12.2010 ENIM Metz, France
Conference: *High Speed Machining*
Presentation: "*Regenerative chatter in composites milling* "
Author(s): **Rusinek R.**, Warminski J., Kęćik K.
- II.J.3. 24-27.11.2010 Poznań University of Technology, Poland
Conference: *Manufacturing 2010*
Presentation: "*Dynamics of composite material cutting*"
Author(s): **Rusinek R.**, Kęćik K., Warminski J.
- II.J.4. **Rusinek R.**, 06-08.09.2010 Łódź University of Technology
Conference: *School of Cutting Process 2010*
Presentation: "*Stability analysis of titanium alloy milling*"
Author(s): **Rusinek R.**, Kęćik K., Warminski J.
- II.J.5. 16-19.03.2009 Wrocław University of Technology
XX CIRP Conference „*HIGH PERFORMANCE MANUFACTURING*, Karpacz, Polska
Presentation: “Chatter in cutting processes”
Author(s): **Rusinek R.**, Warminski J.
- II.J.6. 24-25.09.2009 Wrocław University of Technology
Conference „High Performance Machining, Cutting Machines and Environment”
Presentation "*Inspection of cutting methods of titanium alloys used in aviation industry*"
Author(s): **Rusinek R.**, Warminski J.

- II.J.7. 14-16.09.2009 Lublin University of Technology
Conference „Titanium and Titanium Alloys” Kazimierz Dolny, Poland
Presentation: "*Vibrations in titanium alloys cutting*"
Author(s): **Rusinek R.**
- II.J.8. 07-09.04.2003 Chemnitz University of Technology & Institut Werkzeugmaschinen und Umformtechnik & Volkswagen Stiftung, Germany
4th Symposium "Investigation of Nonlinear Dynamic Effects In Production Systems"
Presentation: "Influence of the workpiece profile on the self-excited vibrations during metal turning process"
Author(s): **Rusinek R.**, Szabelski K., Warminski J.
- II.J.9. 23-24.11.2001 Lublin University of Technology, Kazimierz Dolny
Conference "Questions of Fracture Mechanics and Material Cutting"
Presentation: "An influence of changeable straight turning parameters on final surface quality" (Wpływ zmiennych parametrów toczenia wzdłużnego a jakość powierzchni obrobionej)
Author(s): **Rusinek R.**, Warminski J., Szabelski K., Teter A., Litak G., Lipski J., Zaleski K.
- II.J.10. 15.06.2001 Technical University of Budapest, Hungary
2nd Workshop "Nonlinear Dynamic and Control of Mechanical Processing"
Presentation: "Dynamical model of cutting process changeable in time"
Author(s): **Rusinek R.**, Warmiński J., Szabelski K., Teter A., Litak G., Lipski J., Zaleski K.
- II.J.11. 26-27.09 2000 Volkswagen Stiftung, Germany, Cottbus
3rd Symposium "Investigation of Nonlinear Dynamic Effects In Production Systems"
Presentation: "Modelling of Nonlinear Vibrations in Cutting Process Considering Surface Quality of a Work Material"
Author(s): Lipski J., ., Litak G., **Rusinek R.**, Szabelski K., Teter A., Warmiński J., Zaleski K.

III. International cooperation, organizing and didactic activity

A) European, international and national projects

- III.A.1. "*Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure - CEMCAST*" 7th Framework Programme, Grant No. 245479, 2010-2013, **investigator**
- III.A.2. "*Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification*" 6th Framework Programme of European Union Marie Curie Fellowship for Transfer of Knowledge (ToK). MTKD – CT – 2004 – 014058, 2005 – 2009 **investigator**

- III.A.3. "Restructurization of Bachelor degree study at Faculty of Mechanical Engineering" didactic grant 1997-2001, TEMPUS S_JEP 12242-97 **participant**
- III.A.4. Lectures and calculus exercises for Erasmus students.

B) Activity in scientific conferences

- III.B.1. 29.08-31.08.2012 University of Glasgow, Glasgow, Great Britain
The Modern Practice in Stress and Vibration Analysis
Presentation: " *Chatter control in the milling process of composite materials* "
Author(s): Kęcik K., **Rusinek R.**, Warmiński J., Weremczuk A.
- III.B.2. 10.07-14.07.2012 Vienna University of Technology, Vienna, Austria
ICNPAA Congress: Mathematical Problems in Engineering, Aerospace and Science
Presentation: " *Dynamic Model Of Cutting Process With Modulated Spindle Speed* "
Author(s): **Rusinek R.**, Kęcik K., Warmiński J., Weremczuk A.
- III.B.3. 05.12-08.12.2011 Łódź University of Technology, Poland
11th Conference on Dynamical Systems Theory and Applications, Łódź
Presentation: " *Vibrations of the human middle ear ossicles* "
Author(s): **Rusinek R.**, Warmiński J., Szymański M., Zadroźniak M.
- III.B.4. 28.09-01.10.2011 28th Politzer Society Meeting
Presentation: " *Modelling of Sound Transmission in Human Middle Ear* "
Author(s): **Rusinek R.**, Warmiński J., Szymański M., Zadroźniak M., Morshed K.
- III.B.5. 24-29.07.2011 Sapienza Universita di Roma, Rzym, Włochy
7th European Nonlinear Dynamics Conference
Presentation: " *Regenerative and Frictional Chatter* "
Author(s): **Rusinek R.**, Warmiński J., Kęcik K.
- III.B.6. 27-30.07.2010 University of Aberdeen, Great Britain
Conference: IUTAM Symposium on *Nonlinear Dynamics for Advanced Technologies and Engineering Design*
Presentation: " *Dynamics of Cutting Process of Materials Used In Aviation Industry* "
Author(s): **Rusinek R.**, Warmiński J., Kęcik K.
- III.B.7. 12-15.05.2010 Poznań University of Technology, Będlewo 2010
Conference: " *Vibrations in Physical Systems* "
Presentation: " *Analysis of Human Ear Ossicles Vibrations* "
Author(s): **Rusinek R.**, Warmiński J., Szymański M., Zadroźniak M.
- III.B.8. 24-27.08.2009 The University of Nottingham Malaysia Campus, Kuala Lumpur, Malaysia
Conference: Recent Advances in Nonlinear Mechanics,
Presentation: " *New approach to frictional chatter in metal cutting* "
Author(s): **Rusinek R.**, Wiercigroch M.
- III.B.9. 21-24.05.2008 Lublin University of Technology
„Nonlinear Dynamics of Composite and Smart Structures” Euromech Colloquium

498, Poster: *“Cutting process of composite material: experimental study”*

Author(s): **Rusinek R.**

III.B.10. 11-13.05.2005 University of Zielona Góra, Zielona Góra – Łagów

Conference „Mechanics of non-homogeneous medium”

Presentation: *„Nonlinear modelling of cutting process”*

Author(s): **Rusinek R.**, Szabelski K., Warmiński J.

III.B.11. 15-16.10.2004 Lublin University of Technology, Kazimierz Dolny n. Wisłą, Poland

Conference: Problems of Fracture Mechanics and Material Cutting

Presentation: *„Turning process of Non-circular cross-sectional elements”*

Author(s): **Rusinek R.**, Warmiński J.

III.B.12. 09-11.09.2003 University of Glasgow, Glasgow, Great Britain

Conference: Modern Practice in Stress and Vibrations Analysis

Presentation: *„Vibrations Analysis of Two-Dimensional Model of Metal Turning Process”*

Author(s): **Rusinek R.**, Szabelski K., Warmiński J.

III.B.13. 12.05-13.05.1998 Lublin University of Technology, Lublin

Conference: 4th International Symposium of the Student's Scientific Societies

Presentation: *“The Research of a Containment of Microelements in the Whey from Diary of Lublin by the Method of a Stripping Voltametry”*

Author(s): Rusinek R., Samborski S., Zajęc G.

C) Organizing international and national conferences

III.C.1. Euromech Colloquium 498 *„Nonlinear Dynamics of Composite and Smart Structures”* Kazimierz Dolnym (2008r) – organizing committee.

III.C.2. Workshop *“Nonlinear Dynamic Phenomena in Mechanical, Aerospace, and Civil Engineering”* Lublin University of Technology, CEMCAST project (2012) – organizing committee.

D) Awards not listed in sec. II.I

III.D.1. The Bronze Badge of Society of Engineers and Polish Mechanics SIMP (2011).

E) Participations in consortiums and research networks

III.E.1. **Aeronet - Aviation Valley** which realizes the project *Modern material technologies in aerospace industry” Operational Programme - Innovative Economy (IE OP) financed from the European Regional Development Fund. Project no POIG.0101.02-00-015/08*

F) Managing of projects in cooperation with partners not listed in sec. II.H

III.F.1. „Development of middle ear model and its use to estimate methods of ossicular chain reconstruction” 2009-2012, Project of Ministry of Science and Higher Education (NiSW) No. N N518 425936 realized with Lublin Medical University

G) Participation in journal editor boards

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H) International and national scientific society

- III.H.1. Society of Engineers and Polish Mechanics (SIMP), member since 1995.
- III.H.2. Polish Society of Theoretical and Applied Mechanics, member since 1999r. Treasurer from 2001 to 2010.
- III.H.3. XV Commission of Nonlinear Sciences in Polish Academy of Sciences, branch in Lublin, member since 2003 r.
- III.H.4. Dynamical Systems Section in Mechanics Committee of Polish Academy of Sciences, member from 2007 to 2011.

I) Teaching achievements

III.I.1. Organizing Lublin Science Festival in 2009

III.I.2. Author of didactic programme and student’s books

- didactic programme of Biomechanics
- organizing laboratory of Biomechanics
- Co-author of student’s book “Laboratory of strength of materials” ed. Kazimierz Szabelski and Jerzy Warmański, Lublin University of Technology, **author of 3 laboratory topics**
- Co-author of student’s book “Laboratory of machine dynamics” ed. Kazimierz Szabelski and Jerzy Warmański, Lublin University of Technology, **author of 3 laboratory topics**

III.I.3. Teaching

General Mechanics:

lectures, calculus exercise, laboratory for specialization: Mechanics and Mechanical Engineering, Materials Engineering, Biomedical Engineering, Transport

Mechanical Vibrations:

calculus exercise, laboratory for specialization: Mechanics and Mechanical Engineering

Analytical Mechanics

calculus exercise, laboratory for specialization: Mechanics and Mechanical Engineering

Strength of materials:

calculus exercise, laboratory for specialization: Mechanics and Mechanical Engineering, Materials Engineering

Biomechanics:

lectures, laboratory for specialization: Biomedical Engineering

Physics

laboratory for specialization: Mechanics and Mechanical Engineering, Materials Engineering, Transport, Management and Product Engineering

J) Supervision of MSc students

III.J.1. Four thesis done and five in progress

K) Supervision of PhD students

III.K.1. MSc Eng. Andrzej Weremczuk, PhD thesis "Nonlinear vibrations analysis of mechanical systems with time delay". Auxiliary supervisor since May 2012.

L) Professional experience

III.L.1. Faculté Polytechnique de Mons, Belgia1999 (1 month). Tempus grant S_JEP-12242/97 – "Restructurization of Mechanical Engineering Study"

III.L.2. University of Aberdeen, Great Britain, 2008 (1 month). *Marie Curie Fellowships for Transfer of Knowledge (ToK), Development Host Scheme*, project: "Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification"

III.L.3. University of Aberdeen, Great Britain, 2009 (1 month). *Marie Curie Fellowships for Transfer of Knowledge (ToK), Development Host Scheme*, project: "Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification"

III.L.4. University of Aberdeen, Great Britain, 2012 (3 weeks) project: "Centre of excellence for modern composites applied in aerospace and surface transport" (CEMCAST)

M) Expert opinions

III.M.1. Wyznaczenie statycznych obciążeń naczepy 3 i 5 osiowej – opracowanie na zamówienie.

N) Participation in expert panel

III.N.1. Expert of National Science Centre in Division of Exact and Technical Sciences (ST8B).

O) Project review

III.O.1. National Science Centre since 2012, project review in competition: PRELUDIUM and SONATA. Total number of reviews: 37

P) Review of publications (2010-2012)

III.P.1. Journal of Sound and Vibrations - 1

III.P.2. International Journal of Engineering, Science and Technology - 1

III.P.3. Engineering Modelling - 1

III.P.4. Latin American Journal of Solids and Structures - 1

III.P.5. International Journal of Mechanical Sciences - 5

III.P.6. Theoretical & Applied Mechanics Letters - 1

III.P.7. Maintenance And Reliability - 3

Q) Others achievements, not listed in sec. III.A-III.P

III.Q.1. Review of conference publications - 5

III.Q.2. Chair of the session on conference "High Speed Machining 2010" Metz France.

III.Q.3. Cooperation with University of Aberdeen (Great Britain) in the frame of CEMCAST project and "*Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification*"

III.Q.4. Cooperation with Department of Otolaryngology, Head and Neck Surgery Medical University of Lublin, since 2007 in the frame of project II.H.2, II.H.5, III.F.1.

III.Q.5. Cooperation in the frame of PK Aeronet with Warsaw University of Technology (Institute of Automation, Machine Tools and Metal Cutting), Lodz University of Technology (Institute of Machine Tools and Production Engineering) and Rzeszow University of Technology.

III.Q.6. Cooperation with industry: WSK „PZL – Rzeszów”, PZL Mielec.

III.Q.7. Course "*Mechanical Vibrations: Where Do We Stand?*" International Centre for Mechanical Sciences - Udine, Italy, 13-17.06.2005.

III.Q.8. Course “Nonlinear Dynamics and Chaos for High Volume and Ultra Precision Metal Cutting” International Centre for Mechanical Sciences - Udine, Italy 20-24.09.2004.

III.Q.9. Member of the Council of Mechanical Engineering Faculty, 2005-2008.

III.Q.10. Member of Faculty Commission for Scientific Research and Staff Development, 2012-2016.

5. SUMMARY OF SCIENTIFIC ACHIEVEMENTS

Short information

Lp	Items	Before PhD	After PhD	Total
1	Monographs and thesis	1	1	2
2	Publications in JCR	4	13	17
3	Others publications in refereed journals	4	18	22
4	Publications in conference proceedings	8	20	28
5	Review of publications		16	16
6	Grants (chair of grants)		4 (2)	4 (2)
7	International grants	1	3	4
8	PhD grants	1		1
9	Awards	2	3	5
10	Participating in conferences	8	16	24

List of publications in JCR¹

No	Journal	Title	Author(s)	Year, vol., pages.	IF 2011
1 ^d	<i>Meccanica</i>	Intermittency and Multiscale Dynamics in Milling of Fiber Reinforced Composites	Sen A.K., Litak G., Syta A., Rusinek R.	doi: 10.1007/s11012-012-9631-5	1,558
2 ^d	<i>Proceedings of the Institution of Mechanical Engineers, Part B, Journal of Engineering Manufacture</i>	Stability criterion for aluminium alloy milling expressed by recurrence plot measures	Rusinek R.	doi: 10.1177/0954405412462779	0,725
3 ^d	<i>Latin American Journal of Solids and Structures</i>	Cutting Force Responce in Milling of Inconel: Analysis by Wavlet and Hilbert - Huang transforms	Litak G., Kecik K., Rusinek R.	W druku	0,579

4 ^d	<i>J. of Multi-body Dynamics, Proc. of the Insti. of Mechanical Engineers Part K</i>	Modelling of high-speed milling process with frictional effect	Kęćik K., Rusinek R. , Warmiński J.:	doi: 10.1177/ 1464419312458 636	0,566
5	<i>Meccanica</i>	Dynamics of a Stainless Steel Turning Process by Statistical and Recurrence Analyses	Litak G., Rusinek R.	2012, 47, 1517- 1526	1,558
6	<i>Medical Science Monitor</i>	Vibrations in the Human Middle Ear	Rusinek R. , Szymański M., Warmiński J., Zadrożniak M., Morshed K.	2011, 17(12), 372-376	1,699
7	<i>International Journal of Bifurcation and Chaos</i>	Stability Lobes Analysis of Nickel Superalloys Milling	Kęćik K., Rusinek R. , Warmiński J.:	2011, 21(10), 2943-2954	0,814
8	<i>Journal of Vibroengineering</i>	Vibrations in stainless steel turning: multifractal and wavelet approaches	Litak G., Rusinek R.:	2011,13(1), 1392-8716	0,346
9	<i>Int. Journal of Advanced Manufacturing Technology</i>	Dynamical changes during composite milling: recurrence and multiscale entropy analysis	Litak G., Syta A., Rusinek R.	2011, 56, 445-453	1,103
10	<i>Maintenance And Reliability</i>	Vibrations In Cutting Process Of Titanium Alloy	Rusinek R.	2010, 3, 48-55	0,333
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