AUTOREFERAT

Indication of scientific achievement following article 16 par. 2 of act from 14 March 2003 on scientific degrees and scientific title and on degrees

Krzysztof Kęcik

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CONTENTS

1. Name and Surname

Krzysztof Kęcik

2. Degrees

1998 **Mechanic Technician**

Technical Secondary School in Poniatowa

Specialty: Machine Cutting

2003 **MSc. Eng.**

Lublin University of Technology, Mechanical Faculty

Major: Mechanika i Budowa Maszyn, Specjalność: Technologia Maszyn

MSc thesis: Theoretical and experimental analysis of vibration in cutting process.

2009 **PhD. Eng.**

Lublin University of Technology, Mechanical Faculty

Discipline: Mechanics

PhD thesis: Regular and chaotic vibration of a nonlinear mechanical system with a pendulum.

The thesis was honoured by the Mechanical Faculty Council of Lublin University of Technology.

3. Personal carrer

After graduation in 2003, I was admitted for a one year period for full-time assistant in the Department of Applied Mechanics at the Lublin University of Technology (LUT). After this period, after a positive assessment, the employment was extended. In this year I started the doctoral studies at the Mechanical Faculty at the LUT. The PhD thesis was defended in 04.02.2009, and since 01.10.2009 I worked on the position of the assistant professor.

Academic position:

10/2009 – now

Assistant Professor in Department of Applied Mechanics, Mechanical Faculty, LUT

10/2003 - 09/2009

Assistant in Department of Applied Mechanics, Mechanical Faculty, LUT

4. Indication of scientific achievement following article 16 par. 2 of act from 14 March 2003 on scientific degrees and scientific title and on degrees and title in arts (Journal of Laws no. 65, pos. 595 with changes.)

4.1 Title of the scientific achievement

Monothematic series of publications is entitled:

Non-linear dynamics and energy harvesting of a pendulum vibration absorber with an active suspension

4.2 List of papers presenting the scientific achievement

The composition of the scientific achievements includes eighteen (18) scientific papers published after receiving a PhD degree. In the list of achievements **is seven (7) papers published individual**. The papers are numbered according to the date of publication. In parentheses the impact factors (IF) taken from date of publication are given.

In the list, **the eleven (11) publications are indexed by the database Web of Science (WoS),** including one large chapter of monography published by the Springer (61-pages). **Three papers (3) indexed by the WoS are my individual papers** (3, 5, 12). From seven remaining papers (7), **four publications (4) are my individual papers** (2, 8, 11, 16). The total value of the impact factor (**IF) index for the all monothematic publications equals IF = 10.313**.

My participation in presented publication is between 50-100%. **In the sixteen (16) publications, I am the first author.** The declarations describing my work influence of the all co-authors, for the multi-author of the monothematic publications is provided in the attachment no. 6. The copy of all the paper presented for scientific achievements are given in attachment no. 5. All my publications are listened in attachment no. 3.

The composition of monothematic publications includes

1. **Kecik K**. Mitura A. Non-linear dynamics of a vibration harvest-absorber system. Dynamical Systems Control and Stability. Editors: J. Awrejcewicz, M. Kaźmierczak, J. Mrozowski, P. Olejnik, 2015, 297-306 (position C1 in the attachment no. 3).
   My contribution is 80%.

2. **Kecik K.** Application of shape memory alloy in harvesto-absorber system. Acta Mechanica et Automatica, 2015, 9(3), 155-160, (position B1 in the attachment no. 3).
   My contribution is 100%.

3. **Kecik K.** Dynamics and control of an active autoparametric system. International Journal of Non-linear Mechanics, 2015, 70, 63-72 (WoS, IF=1.977), (position A3 in the attachment no. 3).
   My contribution is 100%.

4. **Kecik K.,** Kapitaniak M. Parametric analysis of magnetorheologically damped pendulum vibration absorber. International Journal of Structural Stability and Dynamics, 2014, 14(8), 1440015, (WoS, IF=0.764), (position A5 in the attachment no. 3).
   My contribution is 80%.

5. **Kecik K.** Control of chaotic dynamics by magnetorheological damping of a pendulum vibration absorber. Structural Engineering and Mechanics, 2014, 51(5), 743-754, (WoS, IF=0.927), (position A4 in the attachment no. 3).
   My contribution is 100%.

6. **Kecik K.,** Mitura A., Sado D., J. Warminski. Magnetorheological damping and semi-active control of an autoparametric vibration absorber. Meccanica, 2014, 49(8), 1887-1900, (WoS, IF=1.949), (position A7 in the attachment no. 3).
   My contribution is 50%.

7. **Kecik K.,** Mitura A. Nonlinear dynamics and control of an active suspension of a pendulum vibration absorber. Machine Dynamics Research, 2014, 38(1), 47–53, (*position B2 in the attachment no. 3*).
   My contribution is 80%.

8. **Kecik K**. An active suspension of a pendulum vibration absorber. Modelowanie Inżynierskie, 2014, 19(50), 83-88, (position B3 in the attachment no. 3).
   My contribution is 100%.

9. **Kecik K.,** Borowiec M. An autoparametric energy harvester. The European Physical Journal Special Topics, 2013, 222(7), 1597–1605 (WoS, IF=1.760), (position A8 in the attachment no. 3).
   My contribution is 90%.

10. **Kecik K.,** Mitura A., Warmiński J. Efficiency analysis of an autoparametric pendulum vibration absorber. Eksploatacja i Niezawodnosc-Maintenance and Reliability, 2013, 15(3), 221–224, (WoS, IF=0.505), (position A9 in the attachment no. 3).
    My contribution is 80%.

11. **Kecik K.** Energy harvesting of a pendulum vibration absorber. Przegląd Elektrotechniczny (Electrical Review), 2013, 2013(7), 169-172, (position B4 in the attachment no. 3).
    My contribution is 100%.

12. **Kęcik K.** Zastosowanie tłumika magnetoreologicznego do sterowania drganiami w układzie mechanicznym z wahadłem (Vibration control of mechanical system with a pendulum by MR damper). Przegląd Elektrotechniczny (Electrical Review), 2012, 88(2), 223-226, (WoS, IF=0.240), (position A14 in the attachment no. 3).
    My contribution is 100%.

13. **Kecik K.,** Warminski J. Chaos in mechanical pendulum-like system near main parametric resonance. Procedia IUTAM, 2012, 5, 249-258 (WoS), (position A13 in the attachment no. 3).
    My contribution is 70%.

14. Warminski J., **Kecik K.** Autoparametric vibrations of a nonlinear system with a pendulum and magnetorheological damping. Nonlinear Dynamics Phenomena in Mechanics. Editors: J. Warminski, S. Lenci, M. P. Cartmell, G. Rega and M. Wiercigroch, 2012, 181, 1-62, 2012, Springer (chapter in monography, WoS, 61 pages), (position A19 in the attachment no. 3).
    My contribution is 50%.

15. **Kecik K.,** Mitura A. Magnetorheological damping of a system with a pendulum vibration absorber. Machine Dynamics Research, 2012, 36(2), 50–57, (position B5 in the attachment no. 3).
    My contribution is 80%.

16. **Kecik K.** Influence of nonlinear damping on dynamics of mechanical system with a pendulum. Vibrations in Physical Systems, 2012, XXV, 223-228 (position B6 in the attachment no. 3).
    My contribution is 100%.

17. **Kecik K.,** Warminski J. Dynamics of an autoparametric pendulum-like system with a nonlinear semiactive suspension. Mathematical Problems in Engineering, 2011, Article ID 451047, Hindawi Publishing Corporation New York (WoS, IF=0.777), (position A16 in the attachment no. 3).
    My contribution is 70%.

18. Warminski J., **Kecik K.** Instabilities in the main parametric resonance area of mechanical system with a pendulum. Journal of Sound Vibration, 2009, 332, 612-628, (WoS, IF=1.414), (position A17 in the attachment no. 3).
    My contribution is 50%.

4.3 Object of studies, aim of publications and obtained results with a possibility applications

My publications concern on the reduction of dangerous vibration regions and energy recovery in the mechanical system. The analysed system consists of the pendulum attached to the movable mass (oscillator) which executes vertical motion (this system is called autoparametric). I propose a new suspension concept which consists of smart elements with variable characteristics (e.g. magnetorheological damper and spring made of shape memory alloy). **The suspension I called an active and it is my original idea.**

The first goal of the presented papers was to get knowledge about the effectiveness and efficiency of the proposed active suspension during dangerous dynamic behaviour and as well as periodic and chaotic dynamic control. The second aim of the papers was to evaluate possibility of energy harvesting of the pendulum vibration absorbers and an analysis of energy harvesting in the dynamic vibration absorption conditions.

This topic I studied during realization of the doctoral thesis, where I considered non-linear dynamics of the two-degree of freedom system which consists of the oscillator and the pendulum. This structure can be applied as a dynamical vibration absorber, in practice. One of the interesting results discovered by me was finding unstable regions near the main parametric resonance. In this region the rotation of the pendulum or chaotic behaviour (two forms: (1) the motion consists of irregular swings of the pendulum (called ''chaotic swings''), and (2) the motion consists of rotation and swings of the pendulum). Therefore, the application of vibration absorber in such region can induce vibrations. The detailed analysis of this problem is shown in paper [18], (the results were obtained during realization of PhD thesis, but published later). In this work I have studied the system analytically with help of the harmonic balance method, numerical simulations and I have performed the experimental verification of the obtained results on the special laboratory rig. The irregular dynamics I have confirmed by the bifurcation diagrams and by reconstruction of the strange attractor.

As a method to reduce or avoid of unstable regions I have proposed a magnetorheological damper in which, the non-linear damping can be changed. An influence of non-linear damping (magnetorheological damper without hysteresis effect) on the dynamic I have analysed in papers [14, 16]. I have pointed, that the magnetorheological damper can reduce irregular dynamic and control vibrations.

I have proposed simply method of the open loop control (*on-off method*), which properly works for large basins of attractor and for a small amount of the coexisting solutions. In these publications, the magnetorheological damper model consists of a viscous damping and a dry friction.

The magnetorheological model with hysteresis effect I have proposed in paper [7]. **I wanted point out that application of a magnetorheological damper (MR) in such systems is my original concept.** Additionally, the mathematical models of a magnetorheological damper (with and without hysteresis) are my author's proposal basin on modify of existing models.

An influence of non-linear damping and non-linear spring on the system dynamics I have published in papers [14, 17]. I have shown that the non-linear suspension elements can reduce or freely moves the dangerous vibration regions, without major loss of absorption effect of the main system (oscillator). This is very important from practical point of view. I have compared an influence of the linear and non-linear damping on the vibration absorption effect, what I have presented in [15].

I have conducted an analysis of the pendulum vibration absorber effectiveness, considering influence of the linear oscillator's damping and the pendulum's damping. **I have shown that damping of the pendulum is a crucial for a dynamic absorption effect** [10]. Therefore, in next my papers I have decided to control the system dynamics by the magnetorheological damper mounted in the suspension. Additionally, the proposed conception does not ''technically'' collide with the energy recovery from the rotational motion of the pendulum. At this time, I have elaborated the conception of energy recovery and vibration reduction at the same time (simultaneously). This idea have been developed in the next my research.

A very extensive analysis of the dynamics of autoparametric system I have presented in the monograph chapter published by Springer [14], where I have shown the results of my research basing on the active suspension analysis. The analysis consists of analytical, numerical and experimental study. I have shown, that by non-linear damper, non-linear spring and a simple control algorithm in an open loop, it is possible to adjust the system response to amplitude and frequency of excitation. I have studied the non-linear damping influence on the occurrence of rotation, oscillations and chaotic behaviour of the pendulum.

I have also shown that, the control in an open loop by on-off method allows to controlled jumps in another attractor. **The research of the vibration control and the solution jump was studied for different dynamics: rotations, oscillations and chaotic behaviour. Next, I have done experimental verification of the possible solutions that is an existence of the pendulum swinging with shifted centre of vibration and reducing this shift by an active suspension. I have proved that a use of a non-linear spring can lead to appear new solutions, depending on the initial conditions.**

After that, I have investigated the stability problem of the inverted pendulum and influence of the non-linear components on dynamical behaviour. **I would like to emphasise, that most of my results have been verified on the laboratory rig, which is designed by myself.** The analysis of experimental results leant on the time series, which have been analysed with help of: the Lyapunov exponent, reconstruction of the phase space, Poincare map and recurrence diagrams and recurrence quantifications.

The experimental study of the control of vibrations and jumps between different solutions with help of magnetorheological damper I have published in paper [12]. The presence of irregular dynamics I have confirmed by experimental bifurcation diagram and the method of delayed coordinates [5, 13].

In the next step, **I have proposed a few closed-loop control algorithms. These results are published in publication [6].** The first algorithm **is designed to the swinging of the pendulum** and was based on activation of the nonlinear damping with help of the magnetorheological damper. This algorithm I have applied to change form of the pendulum swinging, i.e. for jump between the different pendulum's swings with shifted centre of vibration.

The proper value of activated damping (which depends on the pendulum's amplitude) allows change the pendulum swings with positive shifted centre of vibration to the pendulum swings with negative shifted vibration's centre. To achieve the demanded solution, two impulse activation of the magnetorheological damper were sufficient.

The second algorithm is **dedicated to control of the rotation and chaotic motion**. It was based on nonlinear damping and angular velocity of the pendulum. The algorithm is used successfully to changes the swinging of the pendulum in rotation, rotation in swinging, chaotic motion in rotation and rotation in chaos.
In this case, only one short impulse activation of the magnetorheological damper allows obtaining the desired solution. In addition, I have shown, that hysteresis effect of the magnetorheological damper slightly influence on chaotic regions.

I have also studied the stability analysis of the periodic solutions and an influence of all the system parameters to vibration absorption effect by continuation method (in Auto07p software), [4]. **I have proposed two indexes to describe an effectiveness of vibration reduction.**
The first index I have called ''*effectiveness factor*'', which defines the relationship between amplitudes of semi-trivial and non-trivial solutions. This index characterizes the level of vibration reduction. The second index describes the relationship between the maximal and minimal amplitudes of on-trivial solution and characterized the ability to excitation of unwanted vibrations.
The parametric analysis has shown that damping of the pendulum and parameters describing the pendulum construction have a crucial influence on the vibration reduction level. The minimal damping of the pendulum improves the dynamic absorption effect, what is very interesting. However, the linear and non-linear damping of the oscillator decreases resonance region in which the vibration absorption effect exists.

The next my original concept was to use the oscillator's spring made of the shape memory alloys (SMA). I have shown this concept in papers [2, 3, 8], in which I have proposed the **active suspension** consisting of the MR damper and the SMA spring together. The application of the SMA spring enables for application of different SMA spring characteristics which is result from a phase transformation occurring in the SMA structure due to changes of temperature. I have shown, that application of the SMA spring can influence on the vibration absorption effect depending on the system tuning. The activation (or deactivation) temperatures of the SMA spring change the parametric resonance region and can change region and level of the vibration absorption [2]. However, for proper system parameter tuning, the reduction of vibrations is maintaining, and the temperature can be applied to the control [3]. Moreover, the proposed suspension can eliminate areas in which the pendulum induces greater vibration of the oscillator. The use of SMA spring can change the solution stability.

Summing up, I have shown, that the smart elements can be used to control of the pendulum amplitudes (or even it stopped) and to control of vibration reduction level. The activation of the SMA spring can introduce a series of new stable or unstable solutions. Therefore, the system control by the SMA spring must be preceded by a detailed analysis of solutions coexistence.

In order to experimental verification of the obtained results I thoroughly modernized the laboratory rig. The test stand was equips in the control system based on universal measurement and control unit with multi-core processor. The computing unit consists of a DSP core together with fixed –floating point that ensures the algorithm realizing in real time. The temperature of the SMA spring is generated by a current comes from a power supply. The use of SMA spring in dynamic vibration absorption conditions allowed reducing the oscillator vibration about 35%. The experimental studies have demonstrated 8% vibration reduction.

In the experimental study for system with the SMA spring, the obtained results can differ from the numerical ones. Probably, this is caused by adopted MR damper model and keeping the fixed temperature in the SMA spring [3].

Recently, I have focused on energy harvesting analysis from the pendulum oscillator system. **To this end, I have proposed two different designs of devices for energy harvesting. The first solution is dedicated to the pendulum's rotation.** For the pendulum-oscillator system a small electric generator is added, which is mounted in the pendulum suspension point. Such solution is known in the literature, but it is used for classical parametric pendulum (e.g. energy recovery from sea waves). The numerical investigations of such system I have presented in paper [9], where I have found that the most favourable motion for energy harvesting is chaotic motion (consisting mainly from rotation). The energy harvesting form the rotational harvester in the dynamic vibration absorption conditions I have shown in paper [11]. The rotatory harvester properly designed has a very low electrical damping and practically not reduces effectiveness of the dynamic vibration absorption effect.

The second conception bases on the rising and failing motion (oscillations) of a special magnet which executes motion inside the pendulum. In the outer part of pendulum the electrical coil is applied. The magnet is maintained in equilibrium by the magnetic levitation (maglev) phenomenon. The movable magnet is suitable oriented between two fixed magnets. This conception is dedicated to the oscillation of the pendulum. When, the pendulum vibrates, then the magnet oscillates in the coil and generates electrical energy. I would like to point, that this model of the pendulum harvest absorber system is much more complicated, expanded to the four degree of freedom system.

I have built both experimental laboratory rigs for energy harvesting, also. The preliminary results I have presented in the chapter of monograph [1] and in the conference proceedings, which will be indexed by the Web of Science database (position D2 and D3 in the attachment no. 3, the papers are not listed in the monothematic publications).

In paper [1] I have proposed two indexes (indicators of vibration reduction and energy recovery), which describe the level of reduced vibration and recovered energy. On this basis, I have managed to find a ''compromise region'' for energy harvesting and vibration reduction. The experimental results of the oscillator-pendulum-magnet-system will be published in Springer Proceedings in Mathematics and Statistics (the paper is accepted for publication).

A summary of the most important achievements presented in the monothematic publication list:

- ✓ I have proposed a new concept of an active suspension consisting of a magnetorheological damper and a shape memory alloy spring [2, 3, 5, 8],
- ✓ I have proposed a new conception energy harvesting device installed in a pendulum dynamic vibration absorber. This conception based on magnetic levitation phenomenon [1],
- ✓ I have developed a concept for energy recovery from rotational motion of a pendulum [2, 9, 11],
- ✓ I have described in a quantitative way a dynamic vibration absorption effect and energy recovery [1, 4],

- ✓ I have evolved a control method of an active suspension in a closed algorithm dedicated to dynamic vibration absorption (pendulum's oscillation) [6],
- ✓ I have evolved a control method of an active suspension in a closed algorithm dedicated to energy harvesting (control of motion between oscillation-rotation-chaos) [6],
- ✓ I have developed a control in open loop algorithm [12],
- ✓ I have proposed own model of a magnetorheological damper with hysteresis effect [7,15],
- ✓ I have shown influence of a nonlinear damping on a dynamic vibration absorption effect [16, 17],
- ✓ I have presented effectiveness analysis of a pendulum vibration absorber [4, 10],
- ✓ I have developed experimental control algorithm and I have projected two laboratory devices to energy harvesting and I have verified obtained results by experiments [13, 14, 18].

The obtained results, besides publication in the good journals from the JCR list and papers presented during famous conferences (EUROMECH, IUTAM, ENOC, ASME, ICNPAA, ECCOMASS), were used to prepare two research projects.

The first project I got in the program dedicate for young scientist Juventus Plus II, entailed: ''*The dynamic vibration absorption and control of regular and chaotic vibration in a nonlinear autoparametric system''.* This project was very well evaluated and chosen for funding in 2011-2013 years.

The second project entitled *''Estimation of energy harvesting in pendulum vibration absorbers''* I applied to the program Sonata 6. This project also has been very well evaluated and chosen for funding in years 2014-2017.

5. Description of other scientific-research achievements

5.1 General information

Besides, the topic presented in the monothematic publication list, I have analysed and modelled the process of machining of the unworkable materials applied in aviation. The interest in this subject appears during realization of my MSc thesis entitled: *''Theoretical and experimental vibration analysis in turning process''*, and additionally I graduated the Technical Secondary School specializing in the machining.

The main goal of my other publications was to develop effective analysis methods of real measured signal coming from the cutting process of aviation materials (mainly coming from the milling process). The second aim was to build a mathematical model of cutting process, which will explain the essence of machining phenomenon. Another goal was to develop an effective method for avoiding chatter vibration by active vibration excitation of the workpiece or by apply the modulation of the spindle speed.

The obtained results related to the machining process I have presented in the seven publications (7) from the Journal Citation Report (JCR) list (A1, A2, A6, A10, A11, A12, A15). My contribution in these publications ranged from 20% to 60%. In three publications I have been the firs author (A1, A12, A15).

The obtained results I have presented in the conference proceedings indexed by the WoS database (A21, A22) as well. Some of the results I have published in the journals from the list B of Polish Ministry of Science and Higher Education (B7, B8) and in monograph chapters (C2, C4, C5, C6, C7). The results I have presented at the six conference proceedings (K8, K19, K20, K22, K23, K25). One of the papers (K22) I have presented at conference in Metz (France), which was strictly reserved for machining industry. I have been co-author of the eleven (11) conference presentations treating about machining problems (KW5-KW8, KW10, KW11, KW13-KW17). Most of the presentations (8) have been presented on abroad conferences.

I have realized the research project *''Bifurcations and chaos in mathematical cutting models ''*, in which I have been a primary contractor. In addition, I participated in three European research projects related to machining of aviation materials *'' Modern Material Technologies in Aerospace Industry ",* realized under the Innovative Economy Operational Programme and two other projects: *"Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification*" No. 65/6 EU PR / 2005/7, and *"Centre of Excellence for Modern Applied Composites in Aerospace and Surface Transportation Infrastructure - CEMCAST''*, no. FP7–245479. The list of all research projects in which I have been participate in the criteria for assessment of achievements is presented (Section 5.2).

In all mentioned publications I have focused on experimental and numerical studies of milling process. In the paper (A15) I have verified location of the stable milling regions by recurrence plots, recurrence quantifications, Hurst and Lyapunov exponents. I have proposed the indicators, which can be used to detect unstable machining.

In the paper (A12) I have numerically studied milling process, taking into account the friction force (this was a new element in the publication), and the shearing force which depends on the relative velocity between the tip tool and the workpiece. I have estimated the stability milling region (called Stability Lobe Diagram- SLD), for the model without and with friction effect. I have found that friction effect has an influence on the SLD only for certain cutting speed and has an influence on the critical depth of cut. Additionally, I have proposed a new (more practical) indexes for detection stability of milling process. The experimental study of the milling process stability of Inconel 718 I have presented in paper (A11), in which with the help of wavelet and the Hilbert-Huang analysis chatter vibrations were detected.

The stability analysis of milling process by the multiscale entropy analysis is presented in paper (A1). Similar analysis, extension for statistical analysis is presented in work (A2). The rest of my publications have showed the analytical (A6) and analytical-numerical (A2) results of the milling process with an active vibration excitation of the workpiece. These papers have showed, that extra vibration of workpiece can ''improve'' the machining process. Another method, i.e. control by variable modulated speed I have published in publication (A21). Moreover, in the paper (A22) I have presented, that orientation of the fibres in the machining of composite material has an essential influence on the stability process, especially for a system with an active excitation of vibrations.

My experience and scientific knowledge was used in the practical implementation of results in the aviation industry in Mielec (*''Development of guidance for stability milling process based on modal analysis of cutting system and software CutPro''*).

Additionally, my machining experience is related to my other function – auxiliary supervisor of PhD thesis. In this field I have proposed the recurrence plots and recurrence quantifications method to detect damage and defects during machining of the composite materials.

Modelling of the middle ear vibration is another my subject in which I am involved. I analyse middle ear model with the prosthesis made from shape memory alloys. This conception comes from my experience gained during realization my projects with an active suspension. Although, this topic is new for me, but resulted in one patent application *''Middle-ear prosthesis with variable length ''* and participation in the research project in this field.

The detailed description of my other achievements of scientific research are presented in Section 5.2, which I have prepared in accordance with the Regulation of the Minister of Science and Higher Education dated 1 September 2011, the criteria for assessing the achievements of the person applying for the ''habilitacja''.

5.2 Scientific - Research Criterion

5.2.1 Publication form JCR list

In the Web of Science (WoS) database are currently **22 publications**. One publication (A1) will appear in the database in 2016 (this publication is published in January 2016) then all publication in the WoS will **be 23**. Among all publications of WoS, **18 were published in journal, 2 in monography chapter and 3 published in the conference proceeding indexed by WoS.**

In the list of **the Journal Citation Report (JCR) is 17 publications A1-A12 and A14- A18** (according to their year of publication**). Three publications (3) are my individual papers (A3, A4, A14).** The publications are mentioned in chronological order.

My publications from JCR list

A1. **Kecik K.,** Borowiec M., Rusinek R. Verification of the stability lobes of Inconel 718 milling by recurrence plot applications and composite multiscale entropy analysis. The European Physical Journal – Plus, 131(14), 2016, IF=1.377, MNiSW=30 (will be in WoS in 2016).
I estimate my contribution is 60%.

A2. Rusinek R., Lajmert P., **Kecik K.,** Kruszynski B, Warminski J. Chatter identification methods on the basis of time series measured during titanium superalloy milling. International Journal of Mechanical Sciences, 99, 196–207, 2015. IF=2.034, MNiSW=35.
I estimate my contribution is 20%.

A3. **Kecik K**. Dynamics and control of an autoparametric system. International Journal of Non-linear Mechanics, 70, 63-72, 2015. IF=1.977, MNiSW=30.
My contribution is 100%.

A4. **Kecik K**. Control of chaotic dynamics by magnetorheological damping of a pendulum vibration absorber. Structural Engineering and Mechanics, 51(5), 743-754, 2014. IF=0.927, MNiSW=20.
My contribution is 100%.

A5. **Kecik K**., Kapitaniak M. Parametric Analysis of Magnetorheologically Damped Pendulum Vibration Absorber. International Journal of Structural Stability and Dynamics, 14(8), 1440015, 2014. IF=0.764, MNiSW=25.
My contribution is 80%.

A6. Rusinek R., Weremczuk A., **Kecik K.,** Warminski J. Dynamics of a time delayed Duffing oscillator. International Journal of Non-Linear Mechanics, 65, 98-106, 2014. IF=1.977, MNiSW=30.
I estimate my contribution is 20%.

A7. **Kecik K**., Mitura A., Sado D., J. Warminski. Magnetorheological damping and semi-active control of an autoparametric vibration absorber. Meccanica, 49(8), 1887-1900, 2014. IF=1.949, MNiSW=30.
My contribution is 60%.

A8. **Kecik K.,** Borowiec M. An autoparametric energy harvester. The Europen Physical Journal Special Topics 222(7), 1597–1605, 2013. IF=1.760, MNiSW=25.
My contribution is 90%.

A9. **Kecik K.,** Mitura A., Warmiński J. Efficiency analysis of an autoparametric pendulum vibration absorber. Eksploatacja i Niezawodnosc-Maintenance and Reliability, 15(3), 221–224, 2013. IF=0.505, MNiSW=15.
My contribution is 80%.

A10. Weremczuk A., **Kecik K**., Rusinek R. Warmiński J. The dynamics of the cutting process with duffing nonlinearity. Eksploatacja i Niezawodnosc-Maintenance and Reliability, 15(3), 209–213, 2013. *IF=0.505, MNiSW=15.*
I estimate my contribution is 20%

A11. Litak G., **Kecik K.,** Rusinek R. Cutting force response in milling of Inconel: Analysis by wavelet and Hilbert-Huang Transforms. Latin American Journal of Solids and Structures, 10(1), 133-140, 2013. IF=1.272, MNiSW=25.
I estimate my contribution is 30%.

A12. **Kecik K**., Rusinek R., Warminski J. Modeling of high-speed milling process with frictional effect. Proceedings of the Institution of Mechanical Engineers, Part K: Journal of Multi-body Dynamics, 227(1), 3-11, 2013. IF=0.415, MNiSW=20.
I estimate my contribution is 40%.

A13. **Kecik K.,** Warminski J. Chaos in mechanical pendulum-like system near main parametric resonance. Procedia IUTAM, 5, 249-258, 2012. MNiSW=10.
My contribution is 70%

A14. **Kęcik K.** Zastosowanie tłumika magnetoreologicznego do sterowania drganiami w układzie mechanicznym z wahadłem. Przegląd Elektrotechniczny (Electrical Review), 2012(2), 223-226, 2012. IF=0.240, MNiSW=10.
My contribution is 100%.

A15. **Kecik K.,** Rusinek R., Warminski J. Stability lobes analysis of nickel superalloys milling. International Journal Bifurcation and Chaos, 21(10), 1-12, 2011. IF=0.755, MNiSW=30.
I estimate my contribution is 40%.

A16. **Kecik K.,** Warminski J. Dynamics of an autoparametric pendulum-like system with a nonlinear semiactive suspension. Mathematical Problems in Engineering, vol. 2011, Article ID 451047, Hindawi Publishing Corporation New York, 2011. IF=0.777, MNiSW=25.
My contribution is 70%.

A17. Warminski J., **Kecik K.** Instabilities in the main parametric resonance area of mechanical system with a pendulum. Journal of Sound Vibration, 332, 612-628, 2009. IF=1.414, MNiSW=35.
Mój udział 50%

A18. Warminski J., **Kecik K.** Autoparametric vibrations of a nonlinear system with pendulum. Mathematical Problems in Engineering, vol. 2006, Article ID 80705, 1-19, Hindawi Publishing Corporation New York, 2006. IF=0.452, MNiSW=25.
My contribution is 50%

A19. Warminski J., **Kecik K.** Autoparametric vibrations of a nonlinear system with a pendulum and magnetorheological damping. Nonlinear Dynamics Phenomena in Mechanics. Eds. J. Warminski, S. Lenci, M. P. Cartmell, G. Rega and M. Wiercigroch, 181, 1-62, 2012, Springer (chapter of book). MNiSW=10.
My contribution is 50%.

A20. Warmiński J., **Kęcik K.** Regular and chaotic motions of an autoparametric real pendulum system with the use of a MR damper. Modelling, Simulation and Control of Nonlinear Engineering Dynamical Systems. Springer, 267-276, 2009 (chapter of book). MNiSW=10.
I estimate my contribution is 50%.

A21. Rusinek R., **Kecik K**., Warminski J., A. Weremczuk. Dynamic model of cutting process with modulated spindle speed. AIP Conference Proceedings no. 1493, 805-809, 2012. MNiSW=10.
I estimate my contribution is 20%.

A22. **Kecik K**., Rusinek R., Warminski J., Weremczuk A. Chatter control in the milling process of composite materials. Journal of Physics: Conference Series, 382(1) 012012, 2012, 1-6, IOP Publishing. MNiSW=10.
I estimate my contribution is 50%.

A23. Warminski J., **Kecik K**., Mitura A., Bochenski M. Nonlinear phenomena in mechanical system dynamics. Journal of Physics: Conference Series, 382(1) 012004, 1-6, 2012 (WoS). MNiSW=10.
I estimate my contribution is 20%

The total value of the impact factor index (IF) calculated for year of publications for all publications is **IF=19.100.** The number of points according to Polish Higher Ministry Education equals **MNiSW=475** (for list published in 31 December 2014), for all publications of WoS database.

5.2.2 Inventions, patents, commercialization and utility patterns

I am a co-author of one patent application and one commercialization of the research-developed results

1. The patent application: *''Middle ear prosthesis with variable length''*. Application no. P-412144, 2015.
   Authors: Rusinek R., Kecik K., Szymanski M., Kozik K. and Warminski J.
   I estimate my contribution is 20%.

2. Commercialization of the research-developed results, comes from the agreement between the Lublin University of Technology and the Aviation Factory in Mielec: ''Development of guideline for stability determination of milling process based on modal analysis of cutting system using CutProf software. No. 1KMS/2014/ZB1, 9 September 2014.
   Authors: Rusinek R., Kecik K., Warminski J.
   I estimate my contribution is 40%.

5.2.3 Monographs and publications in journals outside JCR

I am the author (co-author) **twelve (12) publications and eight (8) chapters in monographies**, which are not included in JCR database. **Five (5) publications are my individual papers (B1, B3, B4, B6, C3**). Two monography chapters are published in famous publishing house Springer (C2, C4).

My publication in journal (outside JCR)

B1. **Kecik K.** Application of shape memory alloy in harvesto-absorber system. Acta Mechanica et Automatica, 9(3), 155-160, 2015. MNiSW=7.
My contribution is 100%.

B2. **Kecik K.,** Mitura A. Nonlinear Dynamics and Control of an Active Suspension of a Pendulum Vibration Absorber. Machine Dynamics Research, 38(1)1, 47 - 53, 2014. MNiSW=6.
My contribution is 80%.

B3. **Kecik K**. An active suspension of a pendulum vibration absorber. Modelowanie Inżynierskie, 19(50), 83-88, 2014. MNiSW=4.
My contribution is 100%.

B4. **Kecik K.** Energy harvesting of a pendulum vibration absorber. Przeglad Elektrotechniczny (Electrical Review), 2013(7), 169-172, 2013. MNiSW=10.
My contribution is 100%.

B5. **Kecik K.,** Mitura A. Magnetorheological Damping of a System with a Pendulum Vibration Absorber. Machine Dynamics Research. Vol. 36, No 2, 50–57, 2012. MNiSW=6.
My contribution is 80%.

B6. **Kecik K.** Influence of nonlinear damping on dynamics of mechanical system with a pendulum. Vibrations in Physical Systems, XXV, 223-228, 2012. MNiSW=4.
My contribution is 100%.

B7. **Kecik K.,** Rusinek R., Warminski J. Dynamical analysis of milling process with various radial depth of cut. Zeszyty Naukowe Politechniki Poznańskiej. Budowa Maszyn i Zarządzanie Produkcją, 2(16), 69-81, 2011. MNiSW=0.
I estimate my contribution is 60%.

B8. **Rusinek R**., Kecik K., Warminski J. Dynamics of composite materials cutting. Advances in Manufacturing Science and Technology, 35(3), 31-37, 2011. MNiSW=6.
I estimate my contribution is 20%.

B9. **Kecik K**., Warminski J. Analysis of chaotic and regular motions of an autoparametric system by recurrence plots applications. Vibrations in Physical Systems, XXIV, 221-226, 2010. MNiSW=4.
I estimate my contribution is 70%.

B10. Lonkwic P., **Kecik K.**, Lusiak T. The Proper elevator car vibration during a travel. China Elevator, 7, 28-32, 2006. MNiSW=0.
I estimate my contribution is 40%.

B11. **Kecik K.,** Warminski J. Experimental investigations of autoparametric vibrations of a nonlinear system with pendulum. Przegląd Mechaniczny, 12, 86-89, 2006. MNiSW=5.
I estimate my contribution is 70%.

B12. Lonkwic P., **Kecik K.,** Lusiak T. Drgania kabiny dźwigu podczas jazdy. Dozór Techniczny, 5, 115 - 117, 2005. MNiSW=0.
My contribution is 40%.

Chapters in monography

C1. **Kecik K.,** Mitura A. Non-linear dynamics of a vibration harvest-absorber system. Dynamical Systems Control and Stability. Editors: J. Awrejcewicz, M. Kaźmierczak, J. Mrozowski, P. Olejnik, 297-306, 2015. MNiSW=5.
My contribution is 70%.

C2. Litak G., Rusinek R., **Kecik K**., Rysak A., Syta A. Dynamics of composite milling: Application of recurrence plots to Huang experimental modes. Discontinuity and Complexity in Nonlinear Physical Systems Nonlinear Systems and Complexity, 6, 359-367, 2014, Springer. MNiSW=5.
I estimate my contribution is 30%.

C3. **Kecik K.** Bifurcations and control of an autoparametric vibration absorber. Dynamical Systems- Applications. Editors: J. Awrejcewicz, M. Kazimierczak, P. Olejnik and J. Mrozowski, 59-68, 2013.
MNiSW=5,
My contribution is 100%.

C4. Rusinek R., **Kecik K.,** Warminski J. A problem of stability of milling of materials used in avianton industry. IUTAM Symposium on Nonlinear Dynamics for Advanced Technologies and Engineering Design. IUTAM Bookseries. Editors: Marian Wiercigroch, Giuseppe Rega, ISBN: 978-94-007-5741-7. Volume 32, 235-247,2013, Springer. MNiSW=5.
I estimate my contribution is 30%.

C5. **Kecik K.,** Warminski J., Rusinek R. Regenerative and frictional chatter of high speed milling process. Modelling and experiment. Dynamical Systems. Nonlinear Dynamics and Control, Editors by J. Awrejcewicz, M. Kazimierczak, P. Olejnik, J. Mrozowski, 305-310, 2011.
MNiSW=5.
I estimate my contribution is 60%.

C6. Rusinek R. **Kecik K.,** Warminski J. Analiza stabilności procesu frezowania stopu tytanu. Obróbka skrawaniem- Współczesne Problemy. Szkoła Obróbki Skrawaniem, Łódź, 253-260, 2010.
MNiSW=5.
I estimate my contribution is 40%.

C7. **Kecik K.,** Rusinek R., Warminski J. Nonlinear dynamics of superalloys cutting. 10th Dynamical Systems Theory and Applications. DSTA-2009. Editors by J. Awrejcewicz, M. Kazimierczak, P. Olejnik, J. Mrozowski, volume 2, 607-612, 2009. MNiSW=5,
I estimate my contribution is 50%.

C8. **Kecik K**., Warminski J. Control of regular and chaotic motions in autoparametrically system with pendulum by using MR damper. Dynamical Systems Theory and Applications, Łódź, December 17-20. Editors by J. Awrejcewicz, P. Olejnik, J. Mrozowski, volume 2, 649-656, 2007. MNiSW=5,
I estimate my contribution is 60%.

All publications not included in the WoS database has a Polish Higher Ministry points **MNiSW=92.** The list of all my publications together with conference proceedings (the detailed list of all my publications is in attachment no. 3) are shown in Table 1 (before PhD) and Table 2 (after PhD). After PhD I have published a total 10 individual publications and I have been co-author of 52 scientist papers.

Table 1. My publications before PhD.

	Papers	Publications		
		Individually	Co-authors	All
	Before PhD			
1	Publications from JCR list	0	1	1
2	Chapters and monography (included indexed by WoS)	0(0)	1(0)	1(0)
3	Other journal publications	0	3	3
4	Conference proceedings (included indexed by WoS)	0(0)	6(0)	6(0)
	TOTAL	0	11	11

Table 2. My publications after PhD.

Papers		Publications		
		Individually	Co-authors	All
After PhD				
1	Publications from JCR list	3	15	18
2	Chapters and monography (included indexed by WoS)	1(0)	8(2)	9(2)
3	Other journal publications	4	5	9
4	Conference proceedings (included indexed by WoS)	2(0)	24(3)	26(3)
TOTAL		10	52	62

5.2.4 Scientific publications, documentation of research and development

I have prepared of research reports carried out in the framework of the project *"Modern technologies of materials used in the aerospace industry"*, POIG.01.01.02-00-015 / 08-00 in the Operational Programme Innovative Economy (http://pkaero.prz.edu.pl). I am the co-author (author) of thirteen (13) research reports.

1. **Kecik K.** Development of actual method of nickel alloys machining. The selection of technological conditions and tool geometry. Report 1/2009.
   My contribution is 100%.

2. Warmiński J., **Kęcik K**., Rusinek R., Pawłowska B., Wykonanie analizy stabilności procesu frezowania stopów tytanu i niklu w oparciu o wykresy rekurencyjne. The stability analysis of the titanium and nickel alloys milling process based on recurrence diagrams. Report 1/2010.
   I estimate my contribution is 100%.

3. **Kęcik K**., Królicki A. The experimental study of cutting forces depending on depth of cut of cutter milling Execution of experimental values of cutting forces, depending on how the milling cutter recess. Report 2/2010.
   I estimate my contribution is 85%.

4. **Kęcik K.,** Piekarczyk A., Królicki A. The vibration and cutting force analysis of Inconel 718 milling with continuous growth depth of cut. Report 1/2011.
   I estimate my contribution is 80%.

5. Warmiński J., Rusinek R., **Kęcik K.,** Pawłowska B., Piekarczyk A., Królicki A. Numerical and experimental study and verification of chatter phenomenon of aviation materials – stability analysis. Report 2/2011.
   I estimate my contribution is 30%.

6. **Kęcik K.,** Piekarczyk A., Królicki A. Modelling and analysis of machining with active vibration elimination. Report 1/2012.
   I estimate my contribution is 80%.

7. Warmiński J., **Kęcik K.,** Rusinek R., Weremczuk A., Pawłowska B. Analysis of possibility of elimination of chatter vibration during machining of classical and composite materials. Analysis of the influence of active vibration of the workpiece. Report 2/2012.
   I estimate my contribution is 40%.

8. **Kęcik K.,** Piekarczyk A. Experimental study and determination of cutting composite force characteristics versus cutting speed and depth of cut according fibre orientation. Report 1/2013.
   I estimate my contribution is 90%.

9. **Kęcik K.,** Weremczuk A. Machining analysis of graphite-metallic composite: AK20 alloy - experimental study. Report 2/2013.
   I estimate my contribution is 60%.

10. **Kęcik K.,** Piekarczyk A. Numerical continuation analysis of cutting process. Report 1/2014.
    I estimate my contribution is 90%.

11. **Kęcik K.,** Piekarczyk A., Pawłowska B. Numerical two-parameters continuation analysis of cutting proces. Numerical simulation. Report 2/2014.
    I estimate my contribution is 80%.

12. **Kęcik K.,** Piekarczyk A. Detection of damages of carbon composite material based on cutting forces. Report 1/2015.
    I estimate my contribution is 90%.

13. **Kęcik K.,** Królicki A. Damage analysis of machining carbon composite material by Cross Recurrence Plot method. Report 2/2015.
    I estimate my contribution is 90%.

5.2.5 Total impact factor according to Journal Citation Reports (JCR, in the year of publication), citation and Hirsch index.

The total impact factor (IF) of all my publications according to Web of Science database equals **IF=19,100**. The value of IF determined for period before and after PhD (Table 3).

Table 3. Total value of impact factor IF.

Impact Factor (IF)	
Before PhD	0.452
After PhD	18.648
TOTAL	19.100

The number of citations of my publication given by the database Web of Science and Hirsch index are shown in Table 4. For comparison, the statistics for other known bibliographic databases are shown, also.

Table 4. The number of citations and H index value
(data from 15.01.2016)

Hirsch index (H) and citations			
	WoS database	Scopus database	Google Scholar database
Publications	22	28	69
Hirsch index	6	6	9
Citations	86	121	226

5.2.6 Scientific projects (leader or participation)

I have participated in eight (8) research projects. In two projects I have been a leader (2, 3). Additionally, in two I have been a main investigator (4, 7). The list of all research projects, where I take part is presented below.

1. 2014-2017. Dynamics of middle ear with smart prothesis *(SmartEar)*. National Science Centre (OPUS). Project no. DEC-2014/13/B/ST8/04047, (investigator).

2. 2014-2017. Estimation of energy harvesting in pendulum vibration absorbers. Project np. 2013/11/D/ST8/03311. National Science Centre (SONATA), **(head).**

3. 2012-2014, Dynamic vibration elimination and control of regular and chaotic vibrations of non-linear autoparametric system. Ministry of Science and Higher Education. Juventus Plus II. Project ID 0234/IP2/2011/71 **(head)**.

4. 2011-2014. *Bifurcation and chaos in mathematical cutting processes*. National Science Centre (OPUS), Project no. 2011/01/B/ST8/07504, (main investigator).

5. 2010-2013, Capacities/Research Potential, Call FP7- REGPOT-2009-1, Unlocking and developing the research potential of research entities in the EU's convergence regions and outermost regions, "*Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure*", acronym – CEMCAST – co-coordinator prof. T. Sadowski, Lublin University of Technology, contract No. FP7-245479 (investigator).

6. 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).

7. *2006-20009, The vibration analysis of discrete and continuous autoparametric systems made from modern materials. Ministry of Science and Higher Education Project no.* N502 049 31/1449, (Agreement no. 1449/T02/2006/31, (main investigator).

8. 2004-2009, *„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).

5.2.7 International and national awards for scientific activity

I received two prestigious fellowships Marie Curie Foundation for the financing of international courses dedicated to nonlinear dynamics (L'Aquila and Vienna). I received four (4) awards of the Rector of the Lublin University of Technology.

- Second order Rector's team award, Lublin University of Technology 2014/2015.
- Honourable by Elsevier house publishing for performed review, 2014.
- Second order Rector's team award, Lublin University of Technology 2013/2014.
- Second order Rector's team award, Lublin University of Technology 2012/2013.
- Second order Rector's team award, Lublin University of Technology 2006/2007.

- Fellowship of the Foundation Marii Curie, for participation in the course: *''Nonlinear Dynamics and Control of Structure and Mechanical Systems- SICON TC2''*, Vienna, 2008.
- Fellowship of the Foundation Marii Curie, for participation in the course: *''Stability and Bifurcations of Nonlinear Dynamical Systems- SICON TC1''*, L'Aquila, 2007.

5.2.8 International or national thematic conference presentations

I have presented thirty six (36) presentations, but twenty six (26) have been presented after PhD. Additionally, I have presented five (5) other presentations in scientific meeting and panels. I have been co-author of twenty one (21) conference presentations (after PhD). The detail information about my conference presentations are shown in Tables 5 and 6.

Table 5. All conference presentations before PhD.

	Presentation	Number of presentations		
		Presentations delivered personally	Co-author of presentations	All
	Before PhD			
1	Abroad presentation	2	1	3
2	National presentation	6	0	6
3	Other	2	0	2
	Total	10	1	11

Table 6. All conference presentations after PhD.

	Presentation	Number of presentations		
		Presentations delivered personally	Co-author of presentations	All
	After PhD			
1	Abroad presentation	6	13	19
2	National presentation	17	4	21
3	Other	3	4	7
	Total	26	21	47

List of conference presentations

K1. Poland, Lodz, 7-10 December, 2015. 3th International Conference Dynamical Systems Theory and Applications.
Presentation: *Non-linear dynamics of a vibration harvest-absorber system.*
Authors: ***Kecik K,*** *Mitura A.*

K2. Poland, Lodz, 7-10 December, 2015. 3th International Conference Dynamical Systems Theory and Applications.
Presentation: *Non-linear dynamics of a vibration harvest-absorber system. Experimental study.*
Authors: ***Kecik K,*** *Mitura A.*

K3. Poland, Gdansk, 7-11 September, 2015. The 3rd Polish Congress of Mechanics21st International Conference and Computer Methods in Mechanics.
Presentation: *Influence of active elements on the pendulum's rotational motion for energy harvest*ing.
Authors: ***Kecik K,*** *Mitura A.*

K4. Barcelona, Spain, 28 June-2 July. Eccomas Thematic Conference on Multibody Dynamics, Multibody Dynamics 2015.
Presentation: Nonlinear dynamics and bifurcation of a vibration absorber-harvester system.
Authors: Kecik K, Perlikowski P.

K5. Poland, Augustów, 31 may -3 June, 2015. VIII-th International Symposium on Mechanics of Materials and Structures and Fracture and Fragmentation in Science and Engineering Conference.
Presentation*: Application of shape memory alloy in harvesto-absorber system.*
Author: ***Kecik K.***

K6. Poland, Augustów, 31 may -3 June, 2015. VIII-th International Symposium on Mechanics of Materials and Structures and Fracture and Fragmentation in Science and Engineering Conference.
Presentation: Damage detection of composite milling process using recurrence plots technique.
Author: ***Kecik K.,*** *Zaleski K., Ciecieląg K.*

K7. Czech Republic, Brno, 3-5 December, 2014. The 16th International Conference on Mechatronics – Mechatronika 2014.
Presentation: Energy harvesting of an autoparametric pendulum system.
Author: Kecik K.

K8. Poland, Warsaw, 19-20 Maj, XXII French-Polish Seminar of Mechanics.
Presentation*: Nonlinear Dynamics and Control of an Active Suspension of a Pendulum Absorber.*
Authors: ***Kecik K,*** *Mitura A., Warmiński J.*

K9. Poland, Ustroń, 22-26 Luty 2014. 53. Sympozjon ''Modelowanie w Mechanice''.
Presentation: Wpływ parametrów układu na zjawisko dynamicznej eliminacji drgań w nieliniowym układzie mechanicznym z wahadłem.
Authors: ***Kecik K****, Mitura A., Warmiński J.*

K10. Poland, Łodz. 2-5 December. 12th Conference on Dynamical Systems - Theory and Applications (DSTA-2013).
Presentation: Bifurcations and control of an autoparametric vibration absorber.
Author: ***Kecik K.***

K11. Great Britain, Aberdeen, 21-23 August, 2013. Nonlinear Dynamics in Engineering: Modelling, Analysis and Applications. 10th. Anniversary CADR International Conference.
Presentation*: Dynamics of an active autoparametric syst*em.
Authors: ***Kecik K.,*** *Rusinek R., Warminski J. Wiercigroch M.*

K12. Italy, Senigallia, 3-6 June 2013. New Advances in the Nonlinear Dynamics and Control of Composites for Smart Engineering Design. Euromech Colloquium no. 541.
Presentation: Non-linear Dynamics and Magnetorheological Control of a Pendulum System.
Authors: ***Kecik K.,*** *Warminski J.*

K13. Poland, Lublin, 22-23 October, Workshop on Nonlinear Dynamic Phenomena in Mechanical, Aerospace, and Civil Engineering. CEMCAST project for „Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure" FP7-REGPOT-2009-1.
Presentation: Dynamics of an Autoparametric System with a Pendulum and Magnetorheological Damping.
Authors: ***Kecik K****., Warminski J.*

K14. Poland, Warsaw, XX French-Polish Seminar of Mechanics, 21 Maj 2012.
Presentation*: Dynamics of an autoparametric system with a pendulum and a nonlinear suspension*.
*Authors: **Kecik K**, Mitura A., Warmiński J.*

K15. Poland, Warsaw, XX French-Polish Seminar of Mechanics, 21 Maj 2012.
Presentation*: Analysis of efficiently of an autoparametric pendulum vibration absorber.*
*Authors: **Kecik K,** Mitura A., Warmiński J.*

K16. Poland, Będlewo (near Poznań), 15-19 May, 2012. Vibrations in Physical Systems, XXV.
Presentation: Influence of nonlinear damping on dynamics of mechanical system with a pendulum.
Author: Kecik K.

K17. Poland, Lublin. February 6, 2012. Workshop on Research achievements and planned investigations within 7.FP CEMCAST project.
Presentation: Dynamics and analysis of cutting process.
Authors: ***Kecik K**., Rusinek R., Warminski J.*

K18. Poland, Łódź. December 5 -December 8, 2011. XI Conference on Dynamical Systems. Theory and Applications (DSTA-2011).
Presentation: Regenerative and frictional chatter of high speed milling process. Modelling and experiment.
Authors: ***Kecik K.**, Rusinek R., Warminski J.*

K19. *Japan, Kyoto. November 28 - December 2, 2011, IUTAM Symposium of 50 Years of Chaos: Applied and Theoretical.*
Presentation*: Chaos in mechanical systems. Selected Problems*.
Authors: ***Kecik K.,** Rusinek R., Warminski J.*

K20. France, Metz, 8-10 December 2010, (ENIM). Eight International Conference High Speed Machining.
Presentation: Verification of stability lobes of nickel superalloys milling.
Authors: ***Kecik K.,** Rusinek R., Warminski J.*

K21. Poland, Poznań, 24-26 November 2010. 3rd International Scientific Conference with Expert Participation. Manufacturing, Contemporary problems of manufacturing and production management.
Presentation: Vibrations analysis during cutting process of aviation materials.
Autohors: ***Kecik K.,** Rusinek R., Warminski J.*

K22. Poland, Będlewo (near Poznań), 12-15 May 2010. Symposium Vibrations in Physical Systems.
Presentation: Analysis of chaotic and regular motions of an autoparametric system by recurrence plots applications.
Authors: ***Kecik K.,** Warminski J.*

K23. Poland, Łódź, 7-10 December 2009. 10th Conference on Dynamical Systems Theory and Applications. DSTA-2009.
Presentation: Nonlinear dynamics of superalloys cutting.
Autohors: ***Kecik K.,** Rusinek R., Warminski J.*

K24. Poland, Kazimierz Dolny, May 21-24, 2008. Nonlinear Dynamics of Composite and Smart Structures. Euromech Colloquium 498.
Presentation: Magnetorheological Damping of an autoparametrically Excited System.
Authors: ***Kecik K.,** Warminski J.*

K25. Poland, Lodz, 2007. 9th Conference on Dynamical Systems Theory and Applications. DSTA-2007, 17-20 December.
Presentation: Control of Regular and Chaotic Motions of an Autoparametric System with Pendulum by Using MR Damper.
Authors: ***Kecik K.,** Warminski J.*

K26. Ukraine, Kharkov, 2007, 25-28 September. The Second International Conference on Nonlinear Dynamics. Dedicated to the 150th Anniversary of A. M. Lyapunov.
Presentation: Instabilities in the Main Parametric Resonance Area of Mechanical System with Pendulum.
Authors: ***Kecik K.,** Warminski J.*

K27. Poland, Warszawa 2007, I Kongres Mechaniki Polskiej (KMP 2007), 28-31 sierpnia 2007.
Presentation*: Drgania regularne i chaotyczne układu mechanicznego z wahadłem.*
Authors: ***Kecik K.,*** *Warminski J.*

K28. Poland, Kazimierz Dolny, 2007, 5-6 March. Marie Curie Actions - Transfer of Knowledge (ToK) MTKD- CT- 2004-014058.
Presentation: Nonlinear suspension of mechanical autoparametric system with pendulum.
Authors: ***Kecik K.,*** *Warminski J.*

K29. Poland, Kazimierz Dolny, 2006, 8-9 listopad. VII Konferencja Naukowa i V Sympozjum Doktoranckie. Technologiczne Systemy Informacyjne w Inżynierii Produkcji i Współczesne Technologie w Budowie Maszyn.
Presentation: Experimental investigations of autoparametric vibrations of a nonlinear system with pendulum.
Authors: ***Kecik K.,*** *Warminski J.*

K30. Poland, Lublin, 2006, 25-26 September. 16 th International Workshop on Computational Mechanics of Materials, IWCMM 16.
Presentation: Influence of Nonlinear Suspension on Vibrations of Autoparametric System with Pendulum.
Authors: ***Kecik K.,*** *Mitura A., Warminski J.*

K31. Ukraine, Kharkov, 13-19 September 2004. The International Conference "Nonlinear dynamics".
Presentation: Autoparametric vibration of a nonlinear system with pendulum.
Authors: ***Kecik K.,*** *Warminski J.*

5.2.9 Co-author in conference proceedings.

I have co-author of eighteen (18) conference proceedings papers, including four (4) national and fourteen (14) international conferences. Most of the presentations (17) have been obtaining after PhD. This proves about my cooperation in team.

List of presentations presented by co-authors

KW1. Barcelona, Spain, 28 June-2 July. Eccomas Thematic Conference on Multibody Dynamics, Multibody Dynamics 2015.
Presentation: *A numerical study of an autoparametric system with electromagnetic energy harvester*.
Authors: Mitura A., **Kecik K.,** Jarzyna W., Warminski J., Lenci S.

KW2. Buffalo, New York, United States. 17-20 August 2014. ASME 2014 International Design and Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2014).
Presentation: *Vibration control of autoparametric system using SMA spring and MR dampers in the pendula joins*.
Authors: Sado D., Pietrzakowski M., **Kecik K.**

KW2. Vienna, Austria. 6-11 July 2014. 8th European Nonlinear Dynamics Conference (ENOC 2014).
Presentation: Application of magnetorheological dampers to control of a mechanical system with a pendulum.
Authors: Mitura A., **Kecik K.**

KW3. Poland, Ustroń, 22-26 luty 2014. 53. Sympozjon Modelowanie w Mechanice.
Presentation: Badania eksperymentalne układu z wahadłem sterowanego za pomocą tłumika MR oraz sprężyny SMA.
Authors: Mitura A., **Kecik K.,** Warminski J.

KW4. Portugal, Lisbon, 9-12 September 2013. 11th International Conference on Vibration Problems.
Presentation: How friction influences regenerative chatter?
Authors: Rusinek R., **Kecik K.,** Warminski J.

KW5. Great Britain, Aberdeen, 21-23 August, 2013. Nonlinear Dynamics in Engineering: Modelling, Analysis and Applications. 10th. Anniversary CADR International Conference.
Presentation: Bifurcations in frictional model of cutting process.
Authors: Rusinek R., **Kecik K.,** Warminski J.

KW6. Italy, Senigallia, 3-6 June 2013. New Advances in the Nonlinear Dynamics and Control of Composites for Smart Engineering Design. Euromech Colloguium n. 541.
Presentation: Dynamics of Ueda's oscillator with time delay.
Authors: Rusinek R., **Kecik K.,** Warminski J.

KW7. Poland, Lublin, 22-23 October, Workshop on Nonlinear Dynamic Phenomena in Mechanical, Aerospace, and Civil Engineering. CEMCAST project for „Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure" FP7-REGPOT-2009-1.
Presentation: Dynamics of Machining of Composites and Materials for Aviation Industry.
Authors: Rusinek R., **Kecik K.,** Warminski J.

KW8. Great Britain, Glasgow, 29-31 August 2012. Modern Practice in Stress and Vibration Analysis.
Presentation: Nonlinear phenomena in mechanical system dynamics.
Authors: Warminski J., **Kecik K.,** Bochenski M.

KW9. Great Britain, Glasgow, 29-31 August 2012. Modern Practice in Stress and Vibration Analysis.
Presentation: *Chatter control in the milling process of composite materials*.
Authors: Rusinek R., **Kecik K.,** Warminski J.

KW10. Great Britain, Glasgow, 29-31 August 2012. Modern Practice in Stress and Vibration Analysis.
Presentation: *Dynamics of machining of materials used in aviation industry including composite materials*.
Authors: Rusinek R., **Kecik K.,** Warminski J.

KW11. Great Britain, Glasgow, 29-31 August 2012. Modern Practice in Stress and Vibration Analysis.
Presentation: Autoparametric systems with a pendulum and MR damping.
Authors: **Kecik K.,** Warminski J.

KW12. Austria, Vienna, 10-14 July, 2012. ICNPAA Congress: Mathematical Problems in Engineering. Aerospace and Science.
Presentation: Dynamic model of cutting process with modulated spindle speed.
Autohors: Rusinek R., **Kecik K.,** Weremczuk A., Warminski J.

KW13. Italy, Roma, July 24-29, 2011. 7-th European Nonlinear Dynamics Conference.
Presentation: Regenerative and frictional chatter.
Authors: Rusinek R., **Kecik K.,** Warminski J.

KW14. France, Metz, 8-10 December 2010, (ENIM). Eight International Conference High Speed Machining.
Presentation: Vibration analysis during cutting of process aviation materials.
Authors Rusinek R., **Kecik K.,** Warminski J.

KW15. Poland, Poznań, 24-26 November 2010. 3rd International Scientific Conference with Expert Participation. Manufacturing, Contemporary problems of manufacturing and production management.
Presentation: Dynamics of composite material cutting.
Autohors: Rusinek R., **Kecik K.,** Warminski J.

KW16. Poland, Łódź, 6-8 wrzesień 2010.IV Szkoła Obróbki Skrawaniem- Współczesne problemy.
Presentation: Analiza stabilności procesu frezowania stopu tytanu.
Autohors: Rusinek R., **Kecik K.,** Warminski J.

KW17. Australia, Adelaide, XXII International Congress of Theoretical and Applied Mechanics (ICTAM), 25-29 August, 2008.
Presentation: Chaos control by application of magnetorheological damping.
Authors: Warminski J., **Kecik K.**

5.3 Teaching and popularizing achievements. International cooperation.

5.3.1 Participations in consortiums and research networks

I have participated in three European projects

- "Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure - CEMCAST" 7th Framework Programme, Grant No. 245479, 2010-2013, (investigator).
- "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).
- ''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, (investigator).

I have been participated in the three (3) international courses within programme SICON (European consortium cooperating in the field of Stability, Identification and Control in Nonlinear structural dynamics) and CISM (International Centre for Mechanical Sciences).

- Course: *''Nonlinear Dynamics and Control of Structure and Mechanical Systems- SICON TC2''*. A training course coordinated by prof. H. Troger, Vienna University of Technology. Austria, Vienna, February 17-22, 2008.
- Course: *''Stability and Bifurcations of Nonlinear Dynamical Systems- SICON TC1''*. A training course coordinated by prof. A. Luongo, University of L'Aquila. Italy, L'Aquila, July 02-06, 2007.
- Course: *''Mechanical Vibration: Where Do We Stand?''*, was organized by International Centre for Mechanical Science (CISM). Coordinator: Professor I. Elishakoff. Udine, July 13-17, 2005.

5.3.2 Organizing international and national conferences

I have participated in international and national conferences presented in sections 5.2.8 and 5.2.9. I have participated in organization of two conferences, one international and one within the European project ,,Aeronet''.

- Participation in the conference Euromech Colloquium 498 *„Nonlinear Dynamics of Composite and Smart Structures"* in Kazimierz Dolny n. Wisłą, Poland, 2008.
- Participation in the second workshop of ZB1 and ZB2 within project ''Aeronet'', Lublin, Poland, 2010r.

5.3.3 Awards (not listed in section 5.2.7)

Besides, the prizes listened in section 5.2.7 I have obtained two didactic-popularizing awards:

- Winning the competition for the teaching student course '' TECHNE '' of further education: '' Application of the Matlab - Simulink software in engineering problems'', 2014.

• My PhD thesis entailed ,,The regular and chaotic vibrations of a nonlinear mechanical system with a physical pendulum was honored by the Faculty of Mechanical Engineering, Lublin University of Technology, Lublin 2009.

5.3.4 Participations in consortiums and research networks

- Participation in 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

5.3.5 Managing of projects in cooperation with partners.

I have the manager of the research project which is realized in the cooperation with the Università Politecnica delle Marche, Ancona (Italy) and one national polish university (Technical University of Lodz)

- 2014-2017. Estimation of energy harvesting in pendulum vibration absorbers. Project np. 2013/11/D/ST8/03311. National Science Centre (SONATA), (head).
  Cooperation with the Università Politecnica delle Marche (prof. S. Lenci), and Technical University of Lodz (prof. P. Perlikowski).

5.3.6 Participation in journal editor boards

Lack

5.3.7 International and national scientific society

I am a member of several societies and scientific organizations, one of them I was as secretary. Now I am member of the revision commission and education committee.

- Polish Society of Theoretical Applied Mechanics, branch in Lublin, member form 2003.
  In 2013-2014 – I have been a secretary, in 2015-2016 a member of revision commission.
- XV Commission of Nonlinear Sciences in Polish Academy of Sciences, branch in Lublin, member since 200t.
- Member of European Mechanics Society (Euromech) in year 2013, Membership EM 130196.
- Society of Engineers and Polish Mechanics (SIMP), member since 1995, member in 2005-2010 years.
- Member of a Scientific Board of Lublin University of Technology for Mechatronics.
- Member of an Education Committee of Lublin University of Technology for Mechatronics.

5.3.8 Teaching and popularizing achievements

Author of didactic programme and student's books

- Author of didactics programme from: *Technician Mechanics, Modelling of Mechanics System, Mechanics and Physics of Solid Body, Aviation History.*
- I have organized a laboratory from *Technic Mechanic, the laboratory for Modelling of Systems Mechanics, and the laboratory for Mechanics and Physics of Solid Body dedicated to first and second student course*.

- I have prepared two laboratory instructions from the *Biomechanics*.
- I have prepared one laboratory instruction for Erasmus student (Workbook).
- I co-author of didactic book from *''Laboratory of Dynamics and Vibrations''. I have prepared four laboratory instructions.*
- I member of a board for the syllabus preparation.
- I prepared the scientific reports of the Department of Applied Mechanics.

Teaching:

- Classical and Technic Mechanics (lectures, exercises and laboratories for Mechatronics and Machine Building Students).
- Vibration Theory (exercises and laboratories for Machine Building Students)
- Analytical Mechanics (exercises for Machine Building Students)
- Strength of Material (exercises and laboratories for Machine Building and Mechatronics Students)
- Biomechanics (laboratory)
- Modelling of Mechanics Systems (lectures and laboratories for Mechatronics Students)
- Mechanics and Physics of Solid Body (lectures and exercises and Manage and Engineering Production Students)
- Aviation History (free choosing lecture for Machine Building Students).

Science popularization:

- The presentation: *''Concept of smart middle ear prosthesis''* within the Commission of Nonlinear Sciences, Lublin, 27.02.2015.
- Participation in the Lublin Science Festival and presentation: ''Unusual pendulum dynamics behaviour'', Lublin, 23.09.2009.
- The presentation; ,,The regular and chaotic vibration of a non-linear mechanical system with a physical pendulum'', within the Polish Society of Theoretical and Applied Mechanics, Lublin 02.02.2009.
- The participation in the Students Symposium at the Lublin University Technology. Presentation: ''Application of neural network in machining process'', Lublin, 08.05.2003.

5.3.9 Supervision of MSc students

I have been supervisor of nine theses (9), three theses are in progress.

- 9 thesis done (6 MSc and 3 Engineering Thesis),
- 3 in progress (1 MSc and 2 Engineering Thesis).

I have been a reviewer of thirteen (13) of MSC and Engineering thesis. The detailed information in the attachment no. 4 is presented.

5.3.10 Supervision of PhD students

MSc Eng. Krzysztof Ciecielag, PhD thesis "Influence of milling conditions on geometrical structure for selected composites material ". Auxiliary supervisor since September 2013.

5.3.11 Professional experience

I have participated in the six professional experiences of varying lengths (from one week to one month), in two different universities: at the University of Aberdeen (UK) and at the Università Politecnica delle Marche, Ancona (Italy). A total time of my professional experience at the University of Aberdeen was three and a half months. I have been one week visit at was also on a weekly internship at the Università Politecnica delle Marche in Ancona. The second part of this internship has been planned (and confirmed) in July 2016.

- Professional experience at the **Universita Politecnica della Marche w Anconie** (Italy). Period: July 2016 (one week). The cooperation within the project ''Estimation of energy harvesting of a pendulum vibration absorber''. Project no. 2013/11/D/ST8/03311, part II (this visit has been planned and confirmed).

- Professional experience at the **Universita Politecnica della Marche w Anconie (**Italy). Period: 13-18 July 2015 (one week). The cooperation within the project ''Estimation of energy harvesting of a pendulum vibration absorber''. Project no. 2013/11/D/ST8/03311, part I.

- Professional experience at the **University of Aberdeen (Wielka Brytania).** Period: 3 -24 Feburary -2013 (three weeks). The Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure (CEMCAST).

- Professional experience at the **University of Aberdeen (Wielka Brytania)**. Period: 10 October -9 November, 2011 (one month). The Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure (CEMCAST). Presentation: ''Dynamics of an autoparametic pendulum-like system with a nonlinear semiactive suspension''.

- Professional experience at the **University of Aberdeen (Wielka Brytania**). Period: 7 Feburary – 8 March, 2009 (one month). The Marie Curie Action- Transfer of Knowledge, MTKD-CT-3004-014058 -part II. Great Britan, Aberdeen.

- Professional experience at the **University of Aberdeen (Wielka Brytania).** Period: 9 November - 3 December, 2008 (three weeks). The Marie Curie Action Transfer of Knowledge, MTKD-CT-3004-014058 -part I. Presentation: ''Nonlinear Dynamics and Control of an Autoparametric System with a Pendulum'', Great Britain, Aberdeen.

5.3.12 Expert opinions

I have participated in one commercialization of research results in aviation factory in Mielec.

- Commercialization of the research-developed results, comes from the agreement between the Lublin University of Technology and the Aviation Factory in Mielec: ''Development of guideline for stability determination of milling process based on modal analysis of cutting system using CutProf software. No. 1KMS/2014/ZB1, 9 September 2014.
  Authors: Rusinek R., Kecik K., Warminski J.

Additionally I have co-author of the scientific offer dedicated to industry

- Scientific offer no. 9, ''Stability analysis of milling process in HSM machining''. The catalogue of innovation solutions of key project "Modern technologies of materials used in the aerospace industry'', page 25, 2015.
  Authors: Rusinek R., Kęcik K.

5.3.13 Participations in expert panel

Lack

5.3.14 Review of publications (2010-2015)

After PhD I have been reviewer of nineteen publications (19), all publications are listened in JCR list. In 2014 I have received the honourable certificate *''Certificate of* Reviewing'' from the Journal of Sound and Vibration, for the high level reviews.

The list of journals in which I made a review:

- International Journal Stability and Dynamics (3),
- Journal of Sound and Vibration (2),
- Structural Engineering and Mechanics (2),
- Meccanica (1),
- Mechanics Research Communications (1),
- International Journal of Non-Linear Mechanics (1),
- Differential Equations and Dynamical System (1),
- Journal of Chaos (1),
- International Journal of Dynamics and Control (1),
- European Physical Journal - Special Topics (1),
- International Journal of Mechanical Sciences (1),
- Journal of Theoretical and Applied Mechanics (1),
- European Journal of Mechanics (1),
- Mathematical Problems in Engineering (1),
- Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science (1).

5.4 Other information (not listened in Section 5.1, 5.2 and 5.3)

5.4.1 Cooperation with industry

- 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

- Cooperation with WSK „PZL – Rzeszów", PZL Mielec, and Induster Sp. Z.o.o (Lublin)

5.4.2 Courses and Trainings

I have participated in different courses and trainings, which increase my competence

- Course: ''Web of Science – Navigation and Search, 20 October, 2015.
- Course: Impact Factor in Journal Citation Reports analysis", 19 May 2015.
- Courses: ''Scopus and Science Direct training'' at the Lublin University of Technology. Lublin, Poland, 20 November, 2014.
- The English course under project ''Lublin University of Technology of the XXI increase the capacity of university teaching '', 2010.
- The English course under project *''Modern Education- Education- development of modern didactic potential of the* LUT'', 2009.

5.4.3 Certificates

- Certificate; ''Certificate of Reviewing of Journal Sound and Vibration, June 2014
- Certificate: ''Scopus and Science Direct training'' at the Lublin University of Technology, 2014.
- Certificate of LCCI International Qualifications (English Certificate), 2010.
- Certificate of Achievement TOEIC (English Certificate), 2009.
- Certificate of Achievement TOEIC (English Certificate), 2008.
- English certificate: ''Pre-intermediate'', Kursor, Lublin, 2006.
- Russian certificate, intermediate level, Lublin University of Technology, 2003.

5.4.4 Other presentations

I have presented six (6) presentations given at the different scientific meetings. The one presentation (KI2) has been invited by Technical University of Lodz.

The list of other presentations

- KI1. Uniejów, Poland, 19-21 October 2014, VII seminar research task: ZB1, ZB2, ZB5. Modern material technologies in aerospace industry" Operational Programme - Innovative Economy (IE OP)
  Presentation: Modelling of machining process in HSM.
  Author: Kecik K.

- KI2. Poland, Łódź, 18 December 2013. Technical University of Lodz.
  Invited presentation: Nonlinear dynamics and control of an autoparametric system with a pendulum.
  Author: Kecik K.

- KI3. Poland, Warsaw, 30 November, V seminar research task: ZB1, ZB2, ZB5. Modern material technologies in aerospace industry" Operational Programme - Innovative Economy (IE OP).
  Presentation: ''Dynamics of machining process''.
  Author: Kecik K., Rusinek R., Warminski J.

- KI4. Great Britain, Aberdeen, 10 October-9 November 2011. The Centre of Excellence for Modern Composites Applied in Aerospace and Surface Transport Infrastructure (CEMCAST).
  Presentation: Dynamics of an autoparametic pendulum-like system with a nonlinear semiactive suspension.
  Author: Kecik K.

- KI5. Poland, Łódź, 1 czerwiec, 2010. II seminar research task: ZB1, ZB2, ZB5. Modern material technologies in aerospace industry" Operational Programme - Innovative Economy (IE OP).
  Presentation: Verification of stability diagram of milling process of Inconel 718 alloy.
  Author: Kecik K., Rusinek R., Warminski J.

- KI6. Poland, Warszawa, 26 November 2009. I seminar research task: ZB1, ZB2, ZB5. Modern material technologies in aerospace industry" Operational Programme - Innovative Economy (IE OP).
  Presentation: Nickel alloys applied in aviation industry.
  Author: Kecik K.