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UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN

Faculty of Technical Sciences
Department of Mechanical Engineering and the Fundamentals of Machine Design

Wojciech Sobieski

Presentation and abstract

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Sobieski Wojciech
Signature of Applicant

Olsztyn, 2012

1. Basic information

First and last name:	Wojciech Sobieski
Organisational unit:	Department of Mechanical Engineering and the Fundamentals of Machine Design, Faculty of Technical Sciences, University of Warmia and Mazury
Position:	assistant professor
Date and place of birth:	7 May 1972, Olsztyn, Warmia-Masuria Province, Poland
University studies completed/graduations:	Faculty of Mechanical Engineering Academy of Agriculture and Technology in Olsztyn subject: Mechanical Engineering and Machine Design specialty: Vehicle and Machinery Operation
Dates of university degrees:	• 14 November 2012 (Bialystok University of Technology in Bialystok): Assistant Professor • 17 July 1997 (Academy of Agriculture and Technology in Olsztyn, Poland): Master of Science, Engineer (M.Sc. Eng.) • 17 June 2002 (Institute of Fluid-Flow Machinery of the Polish Academy of Sciences (PAS) in Gdańsk, Poland): Doctor of Science (D.Sc.)
Professional career:	• 1997-1999 – assistant lecturer, Department of Mechanical Engineering and Fundamentals of Machine Design, Faculty of Mechanical Engineering, Academy of Agriculture and Technology in Olsztyn (Poland) • 1997-2002 – assistant lecturer, Department of Mechanical Engineering and the Fundamentals of Machine Design, Faculty of Technical Sciences, University of Warmia and Mazury in Olsztyn (Poland) • from 2002 – assistant lecturer, Department of Mechanical Engineering and Fundamentals of Machine Design, Faculty of Technical Sciences, University of Warmia and Mazury in Olsztyn (Poland) • 2009/2010 – research associate, Faculty of Agricultural and Food Sciences, Department of Biosystem Engineering, University of Manitoba (Canada)
Scope:	Technical Sciences
Academic discipline:	Mechanics

2. Professional career

In 1997 I graduated with honours from the master's degree programme at the Faculty of Mechanical Engineering of the Academy of Agriculture and Technology in Olsztyn, studying the subject of Mechanical Engineering and Machine Design, specialising in Vehicle and Machinery Operation. After defending my master's thesis entitled: "The impact of the shape of solids on their falling speed in viscous liquids" I was granted the degree of Master of Science, engineer. Immediately after graduating I paid my attention to the opportunity of working for the Academy of Agriculture and Technology in Olsztyn. It was due to the fact that in the fifth year of my studies, asked by the head of the Department of Mechanical Engineering and the Fundamentals of Machine Design, I conducted classes in Descriptive Geometry for the first year students. Positive experience from that period made me decide to continue my postgraduate education and to begin doctoral studies. From these studies – at the Faculty of Geodesy and Land Management of my original University – I graduated on 17 June 2002 by defending my doctor's dissertation entitled: "Modelling the phenomena of mixing and cavitation in gas-liquid ejectors". The dissertation was defended at the Robert Szewalski Institute of Fluid-Flow Machinery of the PAS in Gdańsk. After being awarded the degree of doctor of science in Mechanical Engineering in the field of Fluid Mechanics, I was employed in the Academy of Agriculture and Technology in Olsztyn as an assistant professor. In 1999 the Academy of Agriculture and Technology in Olsztyn became part of the newly established University of Warmia and Mazury, while the Faculty of Mechanical Engineering became part of the Faculty of Technical Sciences I currently work for.

In 1997-2001, during my doctoral studies, I worked additionally for the Wojewódzki Specjalistyczny Szpital Dziecięcy (Regional Children's Specialised Hospital) in Olsztyn as a computer network administrator. There, I conducted authorial trainings in operating computer and intranet for the hospital staff.

In 2004-2006 I co-operated with a training provider company Infosoft from Olsztyn where I conducted computer courses on IT and I was developing new training courses and their programmes.

At the turn of 2009-2010 I worked for 6 months at the University of Manitoba in Canada, as a research associate. I was dealing with testing flows through porous media, especially using the methods of combining micro- and macro-scale models of those systems.

3. Characteristics of my activity

3.1. General professional activity

As a university teacher I conduct classes in the following subjects: Fluid Mechanics, Numerical Fluid Mechanics, Thermodynamics, Thermal Technology, Descriptive Geometry, Technical Drawing, Engineering Graphics, Programming Languages, Imperative Programming, Engineering Programming, and Alternative Software. A part of the above listed subjects (the underlined ones) were organised by me from the very beginning, mainly for the needs of the specialty Computer Applications in Engineering, started up at the Faculty of Technical Sciences of the University of Warmia and Mazury in Olsztyn in 2001. Since 2010 I have been taking care of the Laboratory of Thermodynamics and Fluid Mechanics, being currently at the stage of intense development as part of an EU project.

My basic research activity includes fluid mechanics, especially stationary and non-stationary experimental and simulation research on porous beds. The term of porous bed means a granular medium consisting of spherical or quasi-spherical particles with a gas or liquid flowing through it. This term covers both traditional granular porous media and fluidised beds, including fountain fluidised beds. In the experimental research I use the equipment available at my university as well as the equipment provided by co-operating units/persons. My simulation research is conducted using the Finite Volume Method (FVM), while the most frequently I use its few extensions intended specially for multi-phase media: Multiphase Eulerian Model, Mixture Model, also referred to as Homogenous Model, as well as the Porous Media Model. Some part of software I need in my research work is developed by me.

Apart from the above mentioned fields of research I conduct research on multi-phase flows with interphase mass exchange (by evaporation, condensation or cavitation) as well as flows, where the bifurcation phenomena occur (especially the so-called Hopf bifurcations).

Another aspect of my activity is being the web designer of my own website (at http://pracownicy.uwm.edu.pl/wojsob/) and various IT, educational, information and social projects grouped around it.

3.2. Research activity

The first experience in research I acquired while developing my M.Sc. thesis. Then, I was especially satisfied with deriving a formula, alternative to the one found in literature, to describe the path covered in time by a spherical body freely falling in a liquid. This period was crowned by the first conference address in my life and my first scientific publication.

When I was preparing my doctoral dissertation, I dealt mainly with numerical modelling of the phenomena of evaporation as well as modelling bifurcation phenomena. These subjects were related to the basic theses of my doctoral dissertation: 1) disintegration of jet working liquid in a liquid-gas ejector occurs by rapid evaporation resulting from filament expansion leaving the working jet, 2) material transportation, as well as the process of working medium suction, is determined by the pulse mixing mechanism, resulting in turn from the bifurcation phenomena that occur in the mixing chamber. During my research I used a non-commercial numerical code Multi Flower 2D based on the Finite Volume Method (FVM) and made accessible to me by my dissertation supervisor, Janusz Badur, D.Sc. from the Institute of Flow Machinery of the PAS in Gdańsk. This computer programme made it possible to model multi-phase flow systems on the basis of the above-mentioned Mixture Model. Because the process of developing the simulation model with the programme was very arduous (the programme consists of several loosely connected files), and it was almost impossible to observe the calculations, I was forced to do some programming job by myself. In the first place, I developed an application to manage the software pack and a brand new postprocessor[1]. The software was developed in the Fortran language, in a graphic mode supported by the BPL. Now I consider that the mastering of the Fortran language and learning numerous programming techniques was one of the most precious practical skills I acquired at that time. After upgrading the software, I began to extend the mathematical model and implement my own procedures in the numerical code. The work resulted in creating the so-called Mass Exchange Model that was defining the process of turning water into water vapour and water vapour into water, under the influence of a locally defined difference between the statical pressure and the saturation vapour pressure; the model took into account the impact of the third component, i.e. the air dissolved in water. The process of mass exchange was defined by the source sections of the mass balance equation for particular mixture components.

[1] For detailed description see: http://pracownicy.uwm.edu.pl/wojsob/ in the Projects section.

In my opinion, the most important scientific results before being awarded the doctor's degree include:

- Developing a simulation model for the experiment conducted by R. Kwidziński[2], regarding the processes of the disintegration of a jet liquid and condensation – the qualitative conformity of results was acquired by me after using the above-mentioned Mass Exchange Model. Other models have not made it possible to obtain similar results.
- Developing a simulation model for the experiment conducted by E. Dyban at al.[3], regarding various forms of bifurcation that occur in the jet-chamber systems – by using the Multi Flower 2D pack I was able to obtain results compliant with the experiment both in terms of quality and quantity. The initial results of the research were presented at the conference in Prague (reported by my thesis supervisor), and then, after defining details, were published in 2001 in a research journal. It is necessary to add here that the possibility of modelling the bifurcation phenomena offered by the Multi Flower 2D pack is not my merit: it is just a software feature used by me that makes it different from many other items of calculation software, including commercial applications (e.g. FLUENT or FlowWorks).
- Developing a simulation model for the operation of an air-air ejector on the basis of experiment conducted by D. Werszko and A. Goliszek[4] – I prepared this model during my one week intern at the Institute of Flow Machinery of the PAS in Gdańsk in 2001, where I familiarised myself with the professional CFD tool, i.e. the FLUENT calculation pack. An important result of research was to determine the operation characteristics of an ejector with numerical methods. The results of this project were published in TASK QUARTERLY in 2003.

Before being awarded the Doctor of Science degree I had been publishing mainly in conference materials (3 domestic and 2 foreign conferences in total) or had been describing my activities in the form of Polish Academy of Science (PAS) reports (16 in total), archived in the Institute of Flow Machinery in Gdańsk.

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[2] Kwidziński R.: Badanie eksperymentalne i teoretyczne struktury stacjonarnej fali uderzeniowej w przeplywach mieszaniny wody i pary. Doctoral disstertation, IMP PAN. Gdańsk, 1997.

[3] Дыбан Е. П., Мазур А. И., Эпик Э. Я.: "Особенности истечения плаской воэдущной струи в тупик". Теплофизика и Теплотеханика, 19, 41-45, (1971).

[4] Werszko D., Goliszek A.: "Wpływ stopnia wymieszania gazu w komorze mieszania strumienicy poddźwiękowej na wskaźniki pracy dyfuzora", works of the Institute of Flow Machinery, Book 87, pp. 41-56, Wroclaw 1984.

After being awarded the doctoral degree and starting work at the Faculty of Technical Sciences of the University of Warmia and Mazury in Olsztyn, I continued my research work regarding the bifurcations in flow systems. Then, I returned to simulation research covering the flow structures in systems of the jet-chamber type, referring to the above-mentioned experiment conducted by E. Dyban. After completing a numerical analysis, being more extensive than previously, I found the possibility of another flow form, not mentioned by the authors of the experiment. The results of the research I presented in 2005 at the GAMM conference (Gesellschaft für Angewandte Mathematik und Mechanik) in Luxembourg. In 2009 I summarised this aspect of research in the paper entitled: "Numerical Analysis of Flow Bifurcations in a Closed-Off Channel" (TECHNICAL SCIENCES), where, additionally, I analysed the associations (transitional forms) between particular bifurcation forms. At the same period I was conducting research on the possibility of Hopf bifurcations in a locally expanded channel, but this time I adopted the following concept: "from a simulation model to the experiment". In the first place I used the numerical method to analyse several geometrical variants of the system, while one of the cases where Hopf bifurcations were found was assumed as a basis to build a lab station. After starting up the lab station it turned out that Hopf bifurcations are clearly noticeable, which proved predicting these structures with simulation methods possible. The results were published in the paper: "Numerical and Experimental Analyses of Hopf Bifurcations in a Locally Expanded Channel" (TECHNICAL SCIENCES, 2009). A summary of the research regarding the problems of bifurcations, this time again considering the aspect of ejectors, was published in 2010 in the paper entitled: "Jet Pumps – Numerical Modeling Possibilities upon the Bifurcation Phenomena" (TECHNICAL SCIENCES). This paper presented a simulation model for the operation of an air-air ejector, where operating medium is sucked up as a result of bifurcations inside the mixing chamber. Thus, I proved that the pulse model of ejector operation could play a significant role in real application devices.

The scientific goals of research on the bifurcation phenomenon included: testing the possibility of predicting the bifurcation phenomena with simulation methods, identifying the forms of bifurcation that can occur in expanded channels, analysing the conditions necessary to create particular bifurcation forms and the relation between them, as well as confirming the significance of bifurcation forms for the operation of ejector-based devices. The assumption of the research conducted was inter alia to improve the knowledge making it possible to solve the problem of modelling in the future, still globally unsolved to date.

One of the problems I was particularly interested in while preparing my doctoral dissertation was cavitation. After having defended my doctoral dissertation I decided to continue dealing with the problem. In 2004 I created a concept of a station for observing and analysing cavitation as well as developed specialty software in the Object Pascal programming language that made it possible to observe and analyse the vibroacoustic spectrum coming from the cavitation generator. The preliminary stage was described in the paper: "A Lab Station for Testing the Phenomenon of Cavitation with the Vibroacoustic Method" (DIAGNOSTYKA, 2004). After constructing the station I published some initial research results in the paper "A Lab Station for Visualising the Phenomenon of Cavitation" included in conference materials (V Workshops: "Modelling the Multi-Phase Flows in Thermochemical Systems – Advanced Measuring Techniques", Stawiska 2005).

In 2006 I published the paper: "Mass Exchange Model in Flows with Cavitation" (TASK QUARTERLY), where I described in detail the Mass Exchange Model and its applications in the context of flows with cavitation. I added the qualitative results from the experiment conducted at a previously prepared lab station. A significant aspect of the paper consisted in including the problem of bifurcation: the experiment made it possible to observe one of the flow structures I knew from the previous research regarding the problem. Interestingly, this structure in a very similar form appeared in the numerical model developed using the Multi Flower 2D pack. Some part of the results and conclusions coming from the paper I used later in the already mentioned paper from the year 2010 regarding the air-air ejector.

The research regarding the phenomenon of cavitation allowed defining the two main scientific goals: developing an automatic system for detecting the phenomenon of cavitation using vibroacoustic methods and the development of mathematical models associated with predicting areas and conditions for the occurrence of cavitation phenomenon in real flow systems. The completion of both goals is at an advanced level, but it has been suspended as a result of taking up new research subjects.

As a result of research subjects I deal with, in 2004 I became – after the proposal put forward by Janusz T. Cieśliński, D.Sc. from the Gdańsk University of Technology – a member of the Multi-phase Flow Section of the Polish Academy of Sciences (PAS).

In autumn 2005 I started co-operation with the Department of Agricultural Engineering Processes of the Faculty of Technical Sciences at the University of Warmia and Mazury in Olsztyn, covering the

numerical modelling for the operation of a fountain grain dryer. The activity was performed as part of the research project KBN No. 2 P06T 062 27, entitled: "Comparing the Brewing Barley Drying Techniques Considering its Malting Quality". The results I obtained – highly compliant with experimental data – were used in the first publication from the Philadelphian list of journals of which I was a co-author: "Drying Characteristics of Barley Grain Dried in a Spouted-Bed and Combined IR-Convection Dryers" (DRYING TECHNOLOGY, 2007).

After completing the project I continued my independent research on modelling the fluid-solid systems. I noticed that particular model parameters had an uneven impact on the results obtained. Because the question is virtually absent in literature, I decided to study in detail the Eulerian Multiphase Model (to be accurate, one of its variants designed to model fluidised beds, the so-called Gidaspow's model) for its sensitivity to the changes of all possible model parameters (such was the scientific goal of that research). It turned out that the subject was selected very accurately and after submitting the related paper in the DRYING TECHNOLOGY journal, in spite of my being given numerous critical remarks, the editor-in-chief, Professor Arun Mujumdar, suggested a few significant changes, listed a bibliography that would turn out to be significant, and even corrected the paper in terms of language by himself. After further corrections and additions, the paper was published under the title: "Numerical Analysis of Sensitivity of Eulerian Multiphase Model for a Spouted Bed Grain Dryer" (DRYING TECHNOLOGY, 2008). Some part of additional aspects was presented in the paper "Influence of Selected Eulerian Multiphase Model Parameters on the Simulation Results for a Spouted Bed Grain Dryer" (TASK QUARTERLY, 2008). In my opinion the most important results of this stage were: to define the sequence and degree of influence of the numerical parameters of particular simulation models on the fountain height as well as the concept of the so-called sensitivity rate, allowing for dimension-free assessment of the influence on any parameter result.

It should be emphasised that during my research using the Eulerian Multiphase Model I did not use the features of the FLUENT programme accessible from the programme interface - I developed, compiled and connected my own procedures to the software (the so-called User Defined Functions). These skills allowed me to move freely within the issue of the so-called "closures", i.e. the fragments of a global mathematical model, defining the particular partial problems. One of the results was to find an error in the official documentation of the FLUENT pack – it appeared that the software calculates a certain part of Gidaspow's model using a slightly different formula than described in the official manufacturer's manual.

During further research I focused on searching, testing and comparing various closures used in the literature for the fluid-solid systems. Taking this work was inspired by my observation that a predominant group of authors choose a particular set of closures without providing comments on their selection and the way of their acquirement. There are only few papers that compare several selected unit models. The basic scientific goal for this stage of research was to develop a possibly extensive and useful base of knowledge dealing with various aspects of fluid-solid system modelling. The activities resulted in developing a few tens of procedures describing the various Eulerian Multiphase Model closures. In my research I was asking the following question: how do the base model results change (the model was described in the paper "Numerical Analysis of Sensitivity of the Eulerian Multiphase Model for a Spouted Bed Grain Dryer."), if particular mathematical model closures are swapped? My work has been divided into a few stages related to particular problems – they have been described in the following papers:

1. Sobieski W.: Momentum Exchange in Solid-Fluid System Modelling with the Eulerian Multiphase Model. DRYING TECHNOLOGY, Vol. 27, No. 5 (2009), pp. 653-671. ISSN 0737-3937 – the paper covered testing altogether 12 models encountered in the global literature for momentum exchange models between the fluid and granular phase used as the Eulerian Multiphase Model closures. This is seemingly the most extensive and comprehensive paper regarding this subject. The most important effect, except for the very model overview, includes showing that virtually the same results as for the base model can be obtained using the three other sets of closures to describe the interphase momentum exchange. At a later date, already after publishing the paper, I found the fourth option. I would like to emphasise some aspect of the work. Most frequently, if an author tested a few models in his research, then, he compared them and showed the most advantageous model in the context of conducted research. In my paper I showed that there were alternative ways of obtaining quantitative results so similar to the experimental ones that it was even hard to show the most accurate model. It was the reader who was not forced to test all options by himself to provide the final interpretation, after analysing the material presented in the paper or at least assess which model should be the most suitable in the particular case. In accordance with its goal, the paper contains a sort of knowledge base on the momentum exchange models in fluid-solid systems as well as on its features and properties.

2. Sobieski W.: Switch Function and Sphericity Coefficient in the Gidaspow Drag Model for Modeling Solid-Fluid Systems. DRYING TECHNOLOGY, Vol. 27, No. 2 (2009), pp. 267-280. ISSN 0737-3937 – in this paper I suggested two modifications for the mathematical model used to date in literature. The first suggestion referred to the change in form of the so-called switch function recently introduced to the Gidaspow theory. I analysed the most advantageous features of the function, overviewed its possibilities and finally, suggested a new formula. A great deal of the paper was devoted to the testing of its properties. One of the significant features of the new formula was the possibility to define two parameters allowing one to control the shape of the function – in the paper I discussed some new possibilities resulting from this feature. The second part of my paper dealt with the so-called sphericity coefficient. This value is introduced to the beds whose shape of particles is not perfectly spherical. So far in the literature this coefficient has adopted the form of an arbitrarily defined constant, while its value has not been discussed in any paper I know. Having been inspired by the discussion induced after my presentation at some conference, I had a closer look at this problem. In the first place I searched the literature, which proved that in some fields, e.g. in the sedimentation theory, there have been different values used to define the sphericity degree of particles for a long time. After having reviewed those formulas (I found altogether four formulas usable in a numerical model), I made a comparison and suggested reducing the Gidaspow model by the sphericity coefficient and replacing it by the so-called shape factor calculated on the basis of real geometry of particles (dimensions in three orthogonal directions). It is worth adding that the sphericity coefficient also occurs in other models describing the interphase momentum exchange (e.g. in the popular Ergun model) – this is the place where research results presented in this paper can be used.
3. Sobieski W.: Drag Coefficient in Solid-Fluid System Modeling with the Eulerian Multiphase Model. DRYING TECHNOLOGY, Vol. 29, No. 1 (2011), pp. 111-125. ISSN 0737-3937 – in another paper from the series regarding the applications of the Eulerian Multiphase Models in the scope of fluid-solid flows I took up the aspect related to the selection of drag coefficient occurring when a single spherical object is placed in a viscous liquid. In total I tested and compared 15 such models, creating, like in the case of paper covering the momentum exchange, a knowledge base regarding the subject. It turned out that the selection of the optimum formula for a particular system is almost impossible without having accurate information on the spatial distribution of the granular phase. The simulations conducted showed also that the key role in the whole task is played by the problem of taking into account

the presence of other objects in the space around the particle (by analysing the problem I came back to the very beginning of my research work, namely, to the subject of my M.Sc. thesis). The theory here is apparently insufficient, while the few solutions applied are not universal in their character. Further research covering this area would be extremely precious and desirable.

In 2008 I took part in preparing two applications for co-financing research projects, where I was listed as a performer of tasks associated with flow modelling. One application was developed at my original Department, while the other at the Białystok University of Technology. Both applications were denied co-financing.

At the beginning of 2009 Professor Arun Mujumdar (editor-in-chief of DRYING TECHNOLOGY) invited me to the 6th Asia-Pacific Drying Conference, October 19-21, 2009, Bangkok, Thailand. After obtaining permission from the Head of my Department I started preparing my presentation and the travel. Because of the parallel opportunity of going to Canada to conduct research, the project was not completed. Despite this, as a consequence of preparations, I created a paper summarising my all achievements to date in the scope of modelling fluid-solid systems entitled: "Selected Aspects of Developing a Simulation Model of a Spouted Bed Grain Dryer Based on the Eulerian Multiphase Model" (DRYING TECHNOLOGY, 2010). In this paper I discussed numerous practical problems useful for preparing a virtual model of the fountain grain dryer and often hard to find anywhere else in the global literature.

Another aspect of research, conducted by me since approximately 2006, has been associated with liquid flows through porous media. This subject appeared independently of remaining ones, as a result of talks with Anna Trykozko, D.Sc. from the Interdisciplinary Centre for Mathematical Modelling of the University of Warsaw. I encountered this person during the meetings of FLUENT software users, held annually in Warsaw; then the plans of conducting common research appeared. As a result of this project some experiments were conducted (using the equipment located in my facility) used at a later time to validate the simulation model. It should be clearly emphasised here that at this stage we applied generally accepted mathematical models. Especially interesting to us was the problem of defining the range of application for the linear Darcy's and the non-linear Forchheimer law (it was not possible to find unambiguous answer to this question in the literature) as well as developing an optimum way to determine coefficients necessary for the calculations. Then, we tested 8 calculations variants, the best of which gave the conformity below 3% throughout the measuring range tested. My direct

contribution to the research, except for preparation of the experiment and processing of the results, included searching the literature for the methods used to determine the so-called Forchheimer's coefficient and performing the analysis of sensitivity, as it was in the case of the Eulerian Multiphase Model. During the work it turned out that the formulas found in the literature are virtually worthless (more than a dozen of formulas gave results differing by more than 7 orders of magnitude) and that the Forchheimer's model is more sensitive to temperature, a parameter that does not occur directly in the Forchheimer's law. This conclusion was one of the most important effects of this stage of work. On the other hand, Anna Trykozko, D.Sc. solved the problem of determining the value of model coefficients on the basis of the so-called Forchheimer plot method. The research results were published in the paper: "Sensitivity Aspects of Forchheimer's Approximation" in the journal TRANSPORT IN POROUS MEDIA (2011). Except for this paper, the results were presented in fragments at three conferences abroad (not by me):

1. Peszyńska M., Trykozko A., Sobieski W.: Forchheimer Law in Computational and Experimental Studies af Flow Through Porous Media at Porescale and Mesoscale. GAKUTO International Series, MATHEMATICAL SCIENCES AND APPLICATIONS, Vol.32, pp. 463-482, Tokyo, Japan 2010.
2. Peszyńska G., Trykozko A., Augustson K., Sobieski W.: Computational Upscaling of Inertia Effects from Porescale to Mesoscale. Conference on Mathematical and Computational Issues in the Geosciences SIAM GS 2009, Leipzig, 15-18 June, 2009.
3. Trykozko A., Peszyńska G., Sobieski W.: Forchheimer Law in Experimental and Computational Studies of Flows Through Porous Media. 5th Polish-Japanese Days "Current Advances in Applied Nonlinear Analysis and Mathematical Modelling Issues" 18-21 May 2009, Warsaw/Mądralin.

In 2009 I began co-operation with the Faculty of Technical Sciences, the Department of Electrical and Power Engineering at the University of Warmia and Mazury in Olsztyn, in modelling of the air flow through the ground-air heat exchangers. I developed a model of such an exchanger; however, I am waiting for newly measured values, as the method used to date to measure the pressure falls in the bed turned out to be excessively inaccurate for the need of the numerical model.

In the same year I had a one-month intern in the manufacturing company Tewes-Bis[5], resulting in identifying the opportunities of co-operation, as well as the report entitled "Possibilities and Strategies of Numerical Modelling of Flow and Thermal Phenomena in a Washer Cooler".

In June 2009 I received an offer of a half-year job in Canada, presented to me by Professor Qiang Zhang from the University of Manitoba in Winnipeg. I accepted the offer and finally in the middle of September of that year I started the research project "Pore Structures and Air Flow Resistance of Bulk Solids". The project consisted in searching for the ways of combining micro- and macro-scale modelling methods of flows through granular porous media. I started considering the ways of solving the problem: I considered the possibility of using models typical for fluidised beds or models designed for porous media. Then, I came across the idea of combining both directions under the common name "porous beds". If the system remains stationary, the name will cover granular porous media, while if it is non-stationary, the name will fit to all the types of fluidised beds. Since then I have been classifying my basic research trends using this very term.

At the beginning of my stay abroad I familiarised myself with the research projects conducted by Professor Qiang Zhang's team, especially with the so-called Discrete Element Method (DEM) making it possible to model the dynamics of granular media (treated as a set of rigid solids interacting mutually and with the walls of the container). The newly acquired knowledge allowed me to develop a world-scale innovative method of determining the geometrical parameters of the bed (especially its porosity and tortuosity) on the basis of the DEM simulation results. The idea is the following: use the DEM to create a representative model for the spatial structure of the real bed, export the information on the size and position of all bed particles to a file, and then calculate the porosity and length of the standard "path" of liquid flowing between two parallel planes on the basis of the exported information. Within a month I created a completely dedicated (my own) computational software (in Fortran 90/95 and Gnuplot languages) as well as the postprocessor visualising the shapes of paths (in the Object Pascal language and using the OpenGL library). The algorithm used in this programme was described first in the research report, then in the paper: "Predicting Tortuosity for Airflow through Porous Beds Consisting of Randomly Packed Spherical Particles", being currently in press in the journal TRANSPORT IN POROUS MEDIA.

[5] The intern was organised as part of another project: "Commerciatlization of research results and creating entrepreneurial attitudes by the UWM in Olsztyn by organising interns, trainings and actions on promoting the academic entrepreneurial attitude", co-financed by the European Union as part of the European Social Fund.

The results of my half-a-year stay at the University of Manitoba include:

- Developing a test station, according to my design and under my supervision, to measure the pressure drops in the porous bed in two perpendicular directions, at vertical and horizontal flow through the bed. The station is quite untypical and it is hard to find any descriptions of such experiments in literature. After completing the test station I used it to perform more than ten series of measurements.
- Writing the paper entitled: "A Simulation Model for Modelling Fluid Flows through Porous Media in 3D Space", where I described the process of creating a 3D model of porous medium on the basis of Ergun and Kozeny-Carman equations. I implemented the model in the FLUENT pack using my own features, while all geometrical data for the Ergun and Kozeny-Carman's models were calculated automatically using the above mentioned dedicated programme developed by me. The aim of this stage of work was to present a seemingly innovative idea for a consistent combination between a micro-scale bed structure and macro-scale models describing a global flow resistance.
- Writing the paper entitled: "Preliminary Experimental and Numerical Investigations of Pressure Losses in Air Flow through a Porous Bed Consisting of Soybean", where I presented the test station built in Canada, the measurement process and results obtained. I used the data to create the simulation model based on the Forchheimer law. After performing an error analysis I found that the discrepancy between the simulation model and the experiment is lower than 3% (in the majority of cases the error was lower than 1%; however, the lowest flow rates involved some speed measurement errors, which was discussed in my paper). This paper constitutes a classic example of using simulation techniques to reconstruct the experiment conditions.

It should be added that developing a consistent and possibly universal mathematical model combining the most advantageous features of micro- and macro-scale approach has currently become a global research problem being solved in many renowned research centres. My papers are aimed at contributing to solve the problem.

In 2010 I submitted a grant application for co-financing research (to the 40th contest organised by the Minister) entitled: "Analysis of the Fluid Flow Resistance during Flow through a Porous Media Based on the Characteristics of its Spatial Structure". The co-financing of the application was denied.

In spring 2011 I began working on a new research subject, this time regarding modelling heat flow in the process of biological decomposition of organic waste (composting). The idea appeared at one of the Engineering Schools for Agricultural Systems in Boszkowo, during the discussion with an employee of the Department of Electrical and Power Engineering of my original Faculty. After familiarising myself with the problems, I noticed the possibility of applying the algorithms developed by me some time ago and regarding the so-called diffusion equation[6]. I started working on the problem and created an initial software version in the Fortran 90/95 programming language. I modified the old 2D algorithms into algorithms allowing for 3D calculations by upgrading them considerably. I put a special emphasis on the fact that all model parameters could be defined with variables in space and in time by using scalar or vector fields. The transition to the 3D mode as well as the need for observing the changes in distribution for particular fields in time made a problem with providing sufficiently easy and quick data visualisation. I solved it by using a free graphic postprocessor ParaView and VTK files generated automatically from the level of the application developed by me. The software developed does not contain the whole model for heat generation and flow in the compost, but it constitutes just a calculation template that requires précising many model closures. The general character of the model results from the lack of appropriate literature – it almost seems that the approach I suggested is innovative on a global scale. This concept I described in my paper: "Possibility to Use the Diffusion Equation to Heat Flow Modeling in a Composting Process" (JOURNAL OF APPLIED COMPUTER SCIENCE, 2011). It is also important that the calculation mechanism developed by me can be used to model other phenomena, diffusive in their character, including molecular diffusion or a change in the current carrier concentration (or other Markov processes). The above-mentioned paper was constructed in such a way as to emphasise it clearly.

The scientific aim of this project stage was to create a mechanism allowing one to easily model the thermal diffusion processes (i.e. the convection-free ones) that in real time need many-week calculations. In general, such calculations constitute a certain problem, because to make the calculations stable, professional calculation programmes, such as for example FLUENT, require using extremely short time steps. As a consequence, the use of real times needed requires performing calculations for months, even on extremely fast computers.

[6] For the purposes of my own development I sometimes create software used to model selected problems of mechanics. Thanks to this I developed e.g. software used to solve the equation of harmonic vibrations, Poisson's equation, wave equation, Korteweg–de Vries equation, simplified Navier-Stockes equation (used to calculate the speed profile in a circular tube) and many others. Some of the programmes are available on my website.

Certain innovativeness in the paper: "Possibility to Use the Diffusion Equation to Heat Flow Modeling in a Composting Process" can be considered the way of introducing the diffusion equation. I expressed it in the form typical for the Numerical Fluid Mechanics, i.e. on the basis of phenomena occurring inside and on the surface of the so-called Control Volume. Thanks to this I acquired the logical conformity with the previously developed own version of basic balance equations for fluid mechanics in the CFD concept. This problem is discussed in the paper: "The Basic Equations of Fluid Mechanics in Form Characteristic of the Finite Volume Method" (TECHNICAL SCIENCES, 2011).

Summarising my research activity I would also like to mention some papers general in their character:

1. Sobieski W.: Examples of Using the Finite Volume Method for Modeling Fluid-Solid Systems. TECHNICAL SCIENCES, No. 13, pp. 256-265 (2010). ISSN 1505-4675 – in this paper I presented six examples for using simulation methods in stationary and non-stationary porous beds: a water flow through the homogenous porous column (experiment conducted by myself, performed in my original university lab); an air flow through the ground-air heat exchanger (the experiment performed in the Department of Electrical and Power Engineering of the Faculty of Technical Sciences at the University of Warmia and Mazury in Olsztyn); an air flow through a grain container (my own experiment, performed in Canada); an air flow through the bed in a fountain drain dryer (an experiment conducted at the Faculty of Technical Sciences, the Department of the Agricultural Processes Engineering at the University of Warmia And Mazury in Olsztyn); flow of water and cottage cheese particles in a washer cooler for cottage cheese production (model constructed on the basis of data provided by the Tewes-Bis manufacturing company from Barczewo) as well as a model for granulate transport using a belt conveyor (on the basis of simulation model was developed later as part of my master of science thesis – lab station). In the paper I discussed and compared the Porous Medium Model and the Multiphase Eulerian Model. This paper constitutes an abridged summary for my activity in the field of porous beds.
2. Sobieski W.: Use of Numerical Models in Validating Experimental Results. JOURNAL OF APPLIED COMPUTER SCIENCE, Vol. 18 No. 1 (2010), pp. 49-60. ISSN 1507-0360 – the paper presents a general concept for reversing the traditional roles of the experiment and the numerical model. I proposed the simulation model to be treated as a tool used to confirm the quality of experiments. The idea is based on reasoning that if there is a mathematical model corresponding to the experiment, then, after entering correct data, it should provide us with

correct results (within a permissible error). On the basis of simple calculations with the application developed by myself, using the Fourier's law, I showed how it can be performed. This paper was inspired by my own experience on creating links between simulation research and the experiment. The idea described herein was re-used later, at the time of modelling the water flow through a porous column, in the paper entitled: "Use of Simulation Methods to Validate the Results of an Experiment", included in the monograph "KNOWLEDGE ENGINEERING AND EXPERT'S SYSTEMS" (Warsaw, 2009).

3. Sobieski W.: Basic Principles and Stages of Computer Modeling in Fluid Mechanics. A chapter in the monograph: "ELEMENTS OF AGRICULTURAL SYSTEM ENGINEERING", pages 111-129, University of Life Sciences, Poznań 2008. ISBN 978-83-7160-501-7 – in this paper I discussed the basic problems regarding the numerical modelling in fluid mechanics, in particular, I defined the three main principles of modelling that I named as follows: Principle of Numerical Experiment Repetition, Principle of Deviations from the Approved Model and the Principle of Flow Problem Similarity. This paper actually does not contain any significant scientific components; it just provides an outline of papers and projects I completed since the beginning of my work at the University as well as constitutes an addition to the teaching materials.

In 2011 I submitted an application for co-financing the research intended for the 1st contest organised by the National Science Centre with new rules, entitled: "The Development of a Method for Measuring the Tortuosity of Granular Porous Media". As part of this project I wanted to extend the theory developed previously while I was working in Canada as well as to construct a utility to measure the tortuosity of porous medium on the basis of my own unique concept. Because currently no such devices are available in the world, a successful project completion would be of noticeable significance for the science. Unfortunately, the grant for funding the project was denied.

In summer 2011, after publishing my first paper in the journal TRANSPORT IN POROUS MEDIA, Professor Oleg Iliev, as the chairman, offered me a membership in the "International Society for Porous Media" (InterPore).

In autumn 2011 I started co-operation with the Faculty of Mechanical Engineering of the Koszalin University of Technology in the field of research on heat and mass transfer in an environmental chamber. Up to the present day I have developed an initial simulation model, whose further extension

will be possible after conducting experiments – they are planned for the years 2012/2013.

In autumn 2011 I submitted an application to the National Science Centre for co-financing the research entitled: "Two-Scale Method for Description the Fluid Flow Resistance in Granular Porous Media Based on a New Model of the Pore Space Structure". This is a modified and upgraded version of the previous application, aimed at basic research. The contest results are planned to be announced in June 2012.

At the end of 2011 the Intech Publisher from Croatia made me a proposal to participate in the creation of a book on fluid mechanics. I have agreed and already prepared one chapter for this book under the title: "Introduction to Multiphase Modeling with the Eulerian Approach". Currently, the text is being reviewed.

As a sort of honour I also consider the recommendation to place information about me and my activity in the database "Who is Who w Polsce" (Who is Who in Poland). This is, according to the editor who interviewed me, a biographical encyclopaedia containing biographies of renowned Poles. The encyclopaedia is printed annually.

3.3. Teaching activity

My first teaching experience was gained at the fifth year of the master's degree study by conducting classes in Descriptive Geometry for non-intramural students. After starting my doctoral studies I was made to conduct classes for the full obligatory teaching hours on the same rules as full time employees of the Department of Mechanical Engineering and the Fundamentals of Machine Design, in Descriptive Geometry, Technical Drawing and Fluid Mechanics. Some additional experience I acquired in 2000 by conducting trainings for physicians and auxiliary staff of the Wojewódzki Specjalistyczny Szpital Dziecięcy (Regional Children's Specialised Hospital) in Olsztyn where at that period I worked as a computer network administrator. For the needs of the training I wrote my first course book entitled: "Windows 98 – A Computer Course".

After being employed at the University I conducted the following classes: Descriptive Geometry (lectures, classes), Engineering Graphics (lectures, classes), Geometry and Engineering Graphics (lectures, classes), Technical Drawing (lectures, classes), Fluid Mechanics (lectures, classes, laboratory), Technical Thermodynamics (laboratory), Thermal Technology (laboratory), Fluid Mechanics and Thermodynamics (laboratory), Numerical Fluid Mechanics (lectures, classes), Programming Languages (lectures, classes), Imperative Programming in Technology (lectures, classes), Engineering Programming (lectures, classes), Alternative Software (lectures). Except for the above-mentioned subjects I also prepared, on the basis of my own programmes, materials used to conduct the Basics for Visual Programming as well as two optional subjects: Web Design and Editorial Techniques.

A significant influence on my teaching activity exerted the fact that my employment at the University coincided with the starting up a new speciality called Computer Usage in Engineering (CUE) at the Faculty of Technical Sciences. Then, I was appointed to develop materials from the very base and conduct lectures as well as classes in the subject: Programming Languages and Numerical Computational Methods in the part covering fluid mechanics. Having neither financial backup nor patterns I began to search for the ways of completing the task. Finally, for the need of the subject Programming Languages I developed my own programming environment called Edi and in 2008 I published a university course book: "GNU Fortran with Data Visualisation Elements". Within a few years I developed two variants for teaching this subject: the first option covered teaching the Fortran and Gnuplot programming environments (data visualisation environment) and DISLIN (graphic library); the other option was based on the Delphi programming environment provided by the Borland

company. Thanks to this I can teach properly the subject called Imperative Programming in Technology and the Basics for Visual Programming or Engineering Programming, depending on each major programme. Likewise, to make it possible to conduct the classes on the Numerical Computational Methods, I upgraded the Multi Flower 2D calculation pack officially delivered in 2001 by Professor Janusz Badur from IMP PAS in Gdańsk, as well as I prepared my own series of lectures, in particular, on the Finite Volume Method. Since 2010 practical classes on the Numerical Computational Methods have been conducted by me on the basis of ANSYS Fluent pack, currently available in the computer lab.

After a few years from launching the speciality Computer Usage in Engineering I proposed to introduce the subject of Alternative Software I currently conduct. This proposal resulted from my fascination with the so-called Free Software I have been popularising among students (and Faculty employees) for years, both at the classes of Alternative Software and at other classes I conduct. In 2009 I wrote a course book for students entitled: "Dissertations in OpenOffice", available free of charge on my website. The publication resulted from the requirements I set to all my M.Sc. candidates, regarding the necessity of editing their theses in the OpenOffice pack (currently LibreOffice) or in the TeX environment. Another paper associated with popularising Free Software, this time in close context with engineering or research, is "Free Software in Engineering Practice" (AGRICULTURAL ENGINEERING, 2009).

As part of my teaching activity I supervise interim papers and engineer and Master of Science theses – in total over 30 such papers/theses.

In the years 2004-2006 I acquired experience as a lecturer working for the training provider Infosoft in Olsztyn, where I conducted the following courses or lectures (in two latter cases I also developed the programme of the course):

- "Information Technologies and multimedia education in school practice" (40 hours),
- "The supervisor of school IT and multimedia centre" (40 hours),
- "Advanced web design techniques" (40 hours),
- "Basics for office applications and information safety in the court operation" (28 hours) – a course ordered by the District Court in Olsztyn,
- "Word, Excel, Outlook in office applications" (28 hours) – a course ordered by

MebelPlast S.A. based in Olsztyn.

In 2006 in this company I had a month's intern[7], where I developed a programme for the new course: "The basics of work in OpenOffice" (40 hours) as well as two series of multimedia presentations: "Open Software in Business" and "The Internet".

Also in 2006 I was appointed by Infosoft, as their best lecturer (the opinion provided based on the analysis of questionnaires), to conduct a training for personnel in Michelin S.A. in Olsztyn on the work time recording system they implemented at that time.

The co-operation with Infosoft resulted in the possibility of participating in other trainings organised by the company. Thus, I attended three courses:

- 2005: "Advanced web design techniques [8]" (40 hours),
- 2006: "Implementing IT technology and its use in improving management and creating a school image" (40 hours – on the basis of MacOS),
- 2005: "Structural and object-based programming in C and C++" (30 hours) – a course ordered by Michelin S.A.

The most important achievement of this period was to learn the basics of C language I currently use to write user's functions in the FLUENT pack as well as mastering web designer skills, including the languages of HTML, XHTML, CSS and the basics of JavaScript. I used the skills to design my own website and the above mentioned programme for the subject: Web Design Techniques.

Within my teaching activity I would like to put a special emphasis on the following projects:

- the "Edi" project – a dedicated programming environment intended for programming in the Fortran 90/95 language. It is available free of charge and the only requirement is registration. So far my website has registered over 300 users from various Polish universities, institutes and schools, commercial organisations as well as private persons dealing with

7 The intern organised as part of project "Regional knowledge transfer within the UWM – employee and student interns in companies".

8 At a later time I developed my own version based on this course, but adopting slightly different assumptions.

programming as a hobby (I register only the supervisors of computer labs, not regular students). The list of those users (as well as the users of Hugo and Multi Flower 2D programmes), including a short description, is available on my website in the section Projects – Register. I would like to emphasise that the number of this pack's downloads registered at various portals (reaching sometimes the number of several thousand at a single portal), numerous letters and queries from the users as well as discussions and favourable comments at various web forums make it the most satisfying project completed in my whole professional career. Unfortunately, the necessity for strictly scientific development has made the project development dynamics fall clearly in recent years with an apparent negative impact on the project. In 2010 I attempted to raise funds for the project development by the application submitted to the 1st "Innovation Factory" Contest – unfortunately, the project was denied financing as non-profitable.

- the "Hugo" project – a clone of the Edi project, intended for the Free Pascal language. Unfortunately, because of lack of time the project is not developed properly (its last version was launched in 2007). So far I have registered about 120 users, mainly teachers (programme is installed in various computer labs), schoolchildren, students and hobbyists; the use of the environment has also been reported by a few scholars and teaching employees as well as full time IT specialists and programmers.
- the "Multi Flower 2D" project – a programme intended for creating computer simulations in the field of compressible fluid mechanics. I am not the author of the solver (except for the fragments related to the Mass Exchange Model); however, I developed a programme that manages the pack, a postprocessor and documentation. Like the two previous ones, this programme is also available free of charge to download from my website. So far I have registered 20 users. Interestingly, I would like to add that according to the information available at http://itcich.p.lodz.pl/Dydaktyka/Pracownia.htm (2012.01.12), this programme – as well as the Edi and Hugo environments – constitutes the software of computer lab of the Department of Thermal and Cooling Technology of the Łódź University of Technology. On the basis of registration statistics I also know that the programme is used by a few academics and teaching employees as well as by at least two engineers from commercial organisations.
- "Examples of using Fortran and visualisation techniques" – a set of programmes developed by myself (currently 15), constituting the illustration for the handbook "GNU Fortran with Data Visualisation Elements" and for the subjects Programming Languages

and Imperative Programming in Technology.

- "Examples for the applications of Borland Delphi environment" – a set of minor author's programmes (currently 21), constituting an illustration for the subjects: Programming Languages, Basics for the Visual Programming and Engineering Programming.

In the years 2006, 2008, 2010 and 2011 I conducted lectures on the Numerical Fluid Mechanics at the Summer Schools of Agricultural Engineering in Boszkowo, organised by Professor Jerzy Weres from the Poznań University of Life Sciences. The subjects of lectures included:

- Research on flows through a porous bed. XXXII SUMMER SCHOOL OF AGRICULTURAL SYSTEM ENGINEERING, Boszkowo, 19 - 21 September 2011
- The Finite Volume Method in multi-phase flows. XXXI SUMMER SCHOOL OF AGRICULTURAL SYSTEM ENGINEERING, Boszkowo, 20 - 21 September 2010
- The basic principles and stages of computer modelling in fluid mechanics. XXX JUBILEE SUMMER SCHOOL OF AGRICULTURAL SYSTEM ENGINEERING, Boszkowo, 21 - 26 September 2008
- The numerical modelling of fluidised beds by using the Eulerian Multiphase Model. XXVIII SUMMER SCHOOL OF AGRICULTURAL SYSTEM ENGINEERING, Boszkowo, 18 - 21 September 2006

3.4. Organisational activity

In the scope of my organisational activity I would like to highlight the following:

- taking care of the Laboratory of Thermodynamics and Fluid Mechanics, in particular, activities aimed at carrying the so-called TECHNO project (extension and modernization of the Faculty of Technical Sciences). The project began in 2007; at that time, I prepared the concept of creating about 30 new laboratory exercises. Then, in the years 2010-2011, I took part in preparing a tender specification, analysing offers, talks with contractors, equipment acceptances, installations, starting ups and testing the stands. In the end I dealt with cataloguing new equipment as well as developing specified procedures for conducting the laboratory exercises. In 2011 I started writing from the very beginning a course book for the students of the Faculty of Technical Sciences at the University of Warmia And Mazury in Olsztyn on thermodynamics.
- since 2009 I have been a member of editorial team of the TECHNICAL SCIENCES journal published by the University of Warmia And Mazury in Olsztyn. In the team I have dealt inter alia with developing procedures regarding the circulation of documents, precising the rules for conducting reviews and accepting or rejecting papers as well as preparing a new version of guidelines for authors. These activities were conducted as part of the action associated with a new mechanism of assessing research journals. Apart from this I deal with consulting regarding current matters associated with the publication of papers.
- proposal, preparation and carrying out at my original Department a training in 2012 on developing research publications in the TeX system. The training covered a general introduction regarding the so-called Philadelphian list of publications, practical workshops covering the TeX system (with a special emphasis put on the arrangement of bibliography) as well as learning the Gnuplot environment, useful in professional preparation of drawings in the formats most frequently requested by Publishers.
- developing in the years 2005-2006, with two other persons, an application for granting rights to award the degree of Doctor of Science (D.Sc.) in the field of Machine Design and Operation. For developing the above-mentioned application, and in general for organisational activity, we were granted a team award grade II from the rector (vice-

chancellor) of the University of Warmia and Mazury in Olsztyn. In this particular action I dealt with setting the application in one consistent document, on the basis of information provided by remaining team members and guidelines supplied by the Faculty authorities.

- developing in 2005 a new version of website for the Subsection of Multi-phase Flow and Non-Newtonian Fluids of the Section of Fluid Mechanics. The website has been inactive since 2011.
- being a tutor for the non-intramural studies in the field of Mechanical Engineering and Machine Design in the years 2003-2008.
- being a tutor for the intramural studies in the field of Mechanical Engineering and Machine Design since 2010.

3.5. Social activity

By social activity I mean any other activities, not only the ones associated with the University, but clearly visible outside for a wider group of people. In my opinion the most important items in this scope include:

- The "FreePC" project (former "FreeCD") – a project intended to popularise the use of Free Software in the society. The idea of the project is to offer to computer users a set of specified programmes coming only from the Free Software stream, used to carry out IT tasks grouped in a few categories: creating basic documents, working in the TeX system, creating and processing graphics, software, web design, using the Internet and multimedia. Apart from some selected programmes and their descriptions, the project included a series of multimedia presentations aimed at informing and explaining. Within the project I popularise only the computer programmes I have personally known and used for a long time both at home and in my professional applications. I would like to add that in 2010 I changed the form of the project: as primarily it was an image of CD with a set of computer applications I recommended and the managing programme developed by me, now this is a set of information and links available at a subpage of my website. The change resulted from the difficulties in accessing the server (the image of CD was located with some breaks on a few different servers in Poland, Germany and in the United Kingdom, made accessible to me by some project supporters), because of lack of time to update as well as because of systematic growth of particular applications – their size became too large for the space of single CD. I would like to add that the "FreeCD" project was completely unique: I have found only two similar initiatives in the whole world, available without updates and solely in the English language.
- The "My Places" project – intended for collecting and providing information on interesting facilities associated with the widely perceived technology, located within the boundaries of the Warmia-Masuria Province. The project uses a website to present descriptions, photos and situation maps. I was the initiator of the project, which resulted from meeting a lover of the region and author of a few books, Tomasz Sowiński. My job was to design the website and update its content. Some descriptions I have added myself; however, the majority of them has been prepared by Tomasz Sowiński. For a short period, the project involved another person, fascinated especially with the history of Old Prussians, former

inhabitants of the region of Warmia and Masuria.

- Since 2011, being a member of the Programme Council of the project "Revitalisation of the Raphaelsohns' lumber mill by converting it into the Centre of Technology and Regional Development "Museum of Modernity" in Olsztyn (with a value exceeding 5 million zlotys), co-financed from the European Regional Development Fund as part of the Warmia and Mazury Regional Operation Programme for the years 2007-2013 (priority axis 4 Development, restructuring and revitalisation of cities, action 4.3 Restructuring post-military and post-industrial areas). In the Council I deal mainly with generating ideas regarding basic matters.
- Exhibition of musical instruments organised in 2008 in the Feliks Nowowiejski Musical Salon in Barczewo. The action has been initiated by the custodian of the salon, Ms. Magdalena Łowkiel, after she found out about my hobby collection of musical instruments (I have more than 30 pieces). On 15 August the ceremony of exhibition opening took place. Apart from several tens of visitors, the opening ceremony was honoured by the mayor of the city of Barczewo Mr. Lech Nitkowski, chairperson of the City Council Elżbieta Zacharewicz, as well as Anna Rok, head of the Municipal Public Library in Barczewo and the editor of "Wiadomości Barczewskie". Information regarding the exhibition was presented in local newspapers and on Radio Olsztyn. The exhibition was open till the end of October. Apart from individual visitors the exhibition was visited by schoolchildren from numerous primary and junior high schools as part of guided tours.
- Interview on the Polish community radio in Winnipeg, Canada, promoting Polish science and the University of Warmia and Mazury among the Poles living there. The interview was initiated by the Polish journalist, after an accidental encounter at a Polish school.
- Developing a lecture and preparing a station to visualise the phenomenon of cavitation on the occasion of the Science Days, on 16 September 2006 (60 minutes).
- Creating and presenting a scientific presentation for the general public on the occasion of the 650th-anniversary of the city of Olsztyn as part of the Days of Olsztyn in 2003 (together with Paweł Pietkiewicz, D.Sc.).