Załącznik 4/Appendix 4

Summary of professional accomplishments

1. **Name and surname**: Dariusz Gąsiorowski

2. **Scientific degrees**

   a. 1998 r.: Master of Sciences, Faculty of Environmental Engineering, Gdańsk University of Technology, field of studies Environmental Engineering, specialization Water Resources Management, MSc thesis title: *Determination of parameters for flood wave equation based on the hydraulics model experiments*

   b. 2006 r.: Philosophy Doctor, the Institute of Hydroengineering of the Polish Academy of Sciences, Gdańsk, PhD thesis title: *Mass and momentum balance in numerical solutions of simplified flood routing models.*

3. **Employment in scientific institutions**

   a. 01.06.1999 to 30.09.2006 r.: assistant at the Institute of Hydroengineering of the Polish Academy of Sciences, Gdańsk;

   b. 01.10.2006 to 31.01.2008 r.: assistant professor at the Institute of Hydroengineering of the Polish Academy of Sciences, Gdańsk;

   c. since 01.02.2008: assistant professor at the Department of Hydraulic Engineering, Faculty of Civil and Environmental Engineering, Gdańsk University of Technology.

I) 4. Scientific achievement required to obtain the habilitation degree according to the Article 16 (2) of the Act

a. **Scientific achievement title**

A series of publications entitled **Modeling of unsteady flows in rivers and floodplains,** which consists of 6 research papers published in 2011-2014, including 4 publications indexed in the Journal Citation Reports. Summary Impact Factor (IF) for the published papers amounts IF = 9,715 (according to the year of publication) (Table. 1), whereas a total number of points, according to the Ministry Science and Higher Education (MSHE) is 170. Taking into account the contribution of co-authors, Impact Factor and score on the MSHE take values 8,233 and 147,5, respectively.

b. **Publications involving the scientific achievement**

1. **Gąsiorowski D.** (2011) Solution of the dike-break problem using finite volume method and splitting technique, TASK Quarterly, vol. 15, no. 3-4, 251-270, score on the MSHE = 9.

2. Szymkiewicz R., **Gąsiorowski D.** (2012) Simulation of unsteady flow over floodplain using the diffusive wave equation and the modified finite element method, Journal of Hydrology, 464-465, 165-175, IF = 2,964, score on the MSHE = 45.

3. **Gąsiorowski D.** (2013) Analysis of floodplain inundation using 2D nonlinear diffusive wave equation solved with splitting technique, Acta Geophysica, vol. 61, no. 3, 668-689, IF = 1,365, score on the MSHE = 20.

4. **Gąsiorowski D.** (2013) Balance errors generated by numerical diffusion in the solution of non–linear open channel flow equations, Journal of Hydrology, 476, 384-394, IF = 2,693, score on the MSHE = 45.

5. **Gąsiorowski D.** (2014) Impact of diffusion coefficient averaging on solution accuracy of the 2D nonlinear diffusive wave equation for floodplain inundation, Journal of Hydrology, 517, 923–935, IF = 2,964, score on the MSHE = 45.

6. **Gąsiorowski D.** (2014) Modelling of flood wave propagation with wet-dry front using diffusive wave equation, Archives of Hydro-Engineering and Environmental Mechanics, vol. 61, no. 3-4, 63-77**,** score on the MSHE = 6**.**

Table 1. Sum of the publications involving the scientific achievement with corresponding percentile contribution of author and values of *Impact Factor* and number of points (according to the MSHE).

Publication	IF	Number of points (MSHE)	Percentile contribution [%]	Taking over contribution of author	
				IF	Number of points (MSHE)
[I.B.1]	0	9	100	0	9
[I.B.2]	2.964	45	50	1.482	22.5
[I.B.3]	1.365	20	100	1.365	20
[I.B.4]	2.693	45	100	2.693	45
[I.B.5]	2.693	45	100	2.693	45
[I.B.6]	0	6	100	0	6
SUM	**9.715**	**170**		**8.233**	**147.5**

c. Objectives and results of the scientific achievement

Despite the increasing development of river structures, the rivers still remain in natural state, or only their sections are partially modified. However, even in the case of river valleys protected by the embankments, the floods periodically occur in adjacent areas due to a dike break or during the controlled inflows of flood water into the polders. The uncontrolled inundation of floodplains is related with the formation of large economic losses and with a potential danger for population living in areas adjacent to the river. For this reason, the rivers and their valleys are the subject of research in terms of modeling of flood flows in the river as well as in adjacent areas. In the former case, it is very important to properly identify a flood extent and the time in which there is a risk of flooding. Moreover, the modeling of flows in rivers and flows over floodplain are directly linked to such issues as:

- forecast for the flood wave propagation in river and over floodplain,
- flood forecast in the river including the outflow through a breach in the dike,
- determination of flood risk zones,

- determination of the lead time for flood warnings in areas located in the immediate vicinity of the river,
- analysis of the possibilities and advisability of creating a polder in order to reduce the flood peak,
- simulation of the flows during the passage of flood wave in the system including river and polder.

In addition, during the detailed formulation of tasks related to the modeling of flood wave propagation we encounter the following problems:

- proper representation of processes in a mathematical model describing the unsteady flow,
- use of the stable, accurate and efficient numerical algorithm to solve equations, which describe a mathematical model,
- appropriate representation of solution domain taking into account its specific,
- acquiring quality data to calibrate and verify the models.

The afore-mentioned series of publications concerns the modeling of unsteady flow in rivers and over floodplains, and my work has focused on the following four main topics:

1. Numerical solution of the shallow water equations which describe the unsteady flow induced by dam- or dike-break.
2. Numerical solution of nonlinear two-dimensional diffusive wave equation describing the flood wave propagation over floodplain.
3. Research concerning the impact of diffusion coefficient averaging on the solution accuracy of nonlinear diffusive wave equation.
4. Study the impact of numerical diffusion on mass balance in numerical solutions of equations describing the propagation of the flood wave.

Ad. 1.

In hydrological practice, we often encounter the problem of determining the extent of floodplain areas directly adjacent to the river. A flood wave propagation over dry area, arising as a result of dike-break, can be simulated using the dynamic wave model. This model is described by means of two-dimensional shallow water equations which are derived on an assumption of the hydrostatic pressure distribution and uniform velocity in depth. Since the floodplain is initially dry, the shallow water equations must be solved in the domain changing over time. Thus, the solution domain is bounded by propagating wave front that separates dry and wet areas. In this case, extremely small water depths occurring at this front give high velocities, which can lead to the numerical instability. This problem is related with numerical approximation of the term representing the friction force in dynamic equation of the shallow water equations. Inadequate approximation causes that this term can achieve significant unbalanced values when very small depths occur in flow over floodplain. Moreover, during the simulation of flows over bottom with complex bathymetry there are areas with transient regime of flow which is usually accompanied by formation of discontinuities in the form of a hydraulic jump. Another example of flow with high gradients in depth and velocity is also a flood wave induced by sudden break of dike or dam. In such cases, the attempt to solve the shallow water equations using standard finite difference or finite element methods leads to significant difficulties that manifest in the form of non-physical oscillations or in excessive smoothing of solution as a result of the use of inaccurate (dissipative) numerical scheme. In order to avoid the above problems, the solution of shallow water equations requires a special numerical algorithms that are often based on the finite volume method (FVM). The result of my research on this problem focuses on developing and verifying a numerical algorithm for solving the two-dimensional shallow water equations by means of the FVM [Appendix 5, item I.B.1]. The applied algorithm of the FVM is based on the wave structure of the approximate solution of the Riemann problem which was proposed by LeVeque'a [1], [2]. In the case of two-dimensional problem, the splitting method with regard to the space independent variables was used in order to simplify the solution to a number of one-dimensional problems, and thereby increasing the computational efficiency of the algorithm. Moreover, in dynamic equations of the shallow water equations, the decomposition with respect to the physical processes was applied. This procedure, proposed by Szymkiewicz [3], provides appropriate approximation of the term representing the friction force. In the study, a verification of algorithm was carried out by comparing the results obtained from numerical model with the existing one-dimensional analytical solution, whereas in the case of two-dimensional problem, the available results of laboratory tests in the form of dam- and dike-break scenarios were analyzed. My study associated with numerical solution of the shallow water equations using the FVM [I.B.1] formed the basis for further research on the application of the diffusive wave model to simulation of unsteady flow over floodplains.

The resulting solutions of the shallow water equations using the FVM lead to satisfactory results. However, this method under certain conditions (e.g. flow over the initially dry area) requires a number of additional modifications to achieve the solution. Applied modifications often result in reducing the accuracy of the obtained solution and increase the complexity of the numerical algorithm. Therefore, there is the increasing tendency in order to search for the alternative models describing the flow over floodplains.

Ad. 2.

The afore-mentioned problems resulting from the application of the shallow water equations for simulation of the flow over floodplain can be eliminated by using the simplified diffusive wave model. Although the simplified models are less accurate than the dynamic wave model, the use of the diffusive wave model ensures sufficiently solution if the assumptions used for the derivation of model are fulfilled. Only in special cases, such as for example a sudden dam- or dike-break, the solutions are obtained with a lower accuracy. However, even in these cases (excluding the area in close proximity of mentioned objects), it is possible to achieve satisfactory results using the diffusive wave model, as it was presented in the paper [I.B.6].

The diffusive wave model is obtained by omitting the inertia force in the dynamic shallow water equations. Due to the simplification, numerical solution of equation describing the diffusion wave model can be performed by algorithms less complex and more efficient, and consequently this approach leads to obtaining solutions in shorter time. In addition, the simulation carried out by using the diffusion wave model does not require a special treatment for a moving front that separates the dry and wet parts of the considered flow area. The current position of this front is the result of numerical solution of the governing equation on the fixed grid point covering the solution domain.

In the case of modeling of unsteady flow over floodplain, the diffusive wave model is mostly derived in the form of a nonlinear two-dimensional transport equation, where unknown function is water level [4]. Due to the nonlinearity of the equation, the development of a numerical algorithm, which leads to a stable and accurate solution is not a trivial task. The most common method to solve the two-dimensional nonlinear diffusion wave equation is the finite difference method. It is interesting that for solution of this equation the finite element method is seldom applied, despite its clear advantage over the finite difference method for a complex area and implementation of boundary conditions. Such a situation can be explained by the fact that the standard finite element method, in the Galerkin formulation, often generates nonphysical oscillations caused by the dispersion of the numerical scheme applied for solution of governing equation, which finally can lead to a breakdown of the calculation. This situation most often occurs when the transport equation describes the advection-dominated flow. However, using the appropriate modification of the standard finite element method, it is possible to reduce or completely eliminate these oscillations. My research undertaken on this topic concerns the modification of the finite element method with triangular mesh for the solution of the two-dimensional diffusion wave equation [I.B.2]. The proposed modification of the finite element method is related to the spatial integration of the equation. Consequently, the application of this approach together with the two-level finite difference at the stage of integration over time leads to a more general algorithm with the two weighting parameters. As part of study I carried out the numerical stability analysis performed by the Neumann method and an accuracy analysis performed using the modified equation method. The numerical research allowed the identification of variability in values of weighting parameters for which the solution is obtained without oscillations, and at the same time the impact of numerical diffusion on solution is minimized. Moreover, the accuracy analysis showed that by selecting of an appropriate structure for triangular mesh and the adequate values of weighting parameters, the modified algorithm provides a stable and accurate solution with an approximation of 3nd order with respect to time as well as spatial variables.

In addition to the accuracy of the numerical scheme, an important problem states also its efficiency defined as the number of operations carried out at a certain time. This issue deserves a special attention in the analysis of two-dimensional flows over the vast floodplains. In such problems, as a result of discretization, we receive a large system of algebraic nonlinear equations that must be solved at each time level of simulation period. In my research on this topic I applied the directional decomposition, with regard to the spatial variables, for the solution of the two-dimensional diffusive wave equation [I.B.3]. According to this splitting method, a solution of the two-dimensional equation at a given time level is reduced to the solution of set one-dimensional equations for each of the directions of the coordinate system. Consequently, the splitting technique leads to the tri-diagonal systems of algebraic equations and we get a simpler and more efficient algorithm for solving them. In addition, the directional decomposition allows the use of a rectangular grid nodes, which can easily cover the domain of any geometry. It is the only requirement, that rectangular grid has to include the entire modeled area, where the propagating front of flood wave is expected. Summarizing, the combination of directional decomposition with the modified finite element method ensure the development of efficient and stable numerical scheme, which also has adequate accuracy required during simulation of the unsteady over floodplains.

Ad. 3.

Two-dimensional nonlinear diffusion wave equation is a partial differential equation of 2^{nd} order of parabolic type, in which the hydraulic diffusion coefficient depends on the depth of the water, the elevation of the water table and its spatial derivative. The non-linearity of this relationship causes the complications at the stage of numerical solution of the diffusive wave equation. Therefore, regardless of the choice of the numerical scheme for spatial discretization, the hydraulic diffusion coefficient must be approximated by adequate averaging its values in two adjacent nodes. One of the most popular approaches for averaging of the diffusion coefficients is the arithmetic mean with respect to the water depth [5], [6]. In my research on this topic [I.B.5], I have showed that this method of averaging can provide the unexpected effects in numerical solution. This problem is especially apparent for overland flow with a steep wave front or for steady flow over an obstacle. In the latter case, an inadequate approximation of the diffusion coefficients by the standard arithmetic average leads to the non-physical solutions manifested in excessive accumulation of water volume over obstacle. In my work, I explained the mechanism of this effect, and I presented an alternative method of averaging for diffusion coefficient, which provides the correct numerical solution for a wide range of analyzed flows that may occur on the floodplain.

Ad. 4.

The nonlinear equations describing the models of unsteady flow (dynamic, diffusive and kinematic wave model) can be written in the conservative (divergence) form or non-conservative form with respect to fulfillment of the basic principles of conservation of mass and momentum. Non-conservative from or inadequate conservative form of nonlinear equation causes that the mass balance errors are generated in numerical solutions. This problem is especially significant for the equations of the simplified flood routing models such as the diffusion wave model or kinematic, as I have shown in my dissertation.

Another important issue is also the impact of numerical errors (e.g. the numerical diffusion error) on the mass balance error in numerical solution of nonlinear equations written in improper form. It is worth to add that this problem has not yet been considered. In my research devoted to this problem I focused on one-dimensional nonlinear equations of hyperbolic type, which describes the dynamic and the kinematic wave model. Research results were presented in the publication [I.B.4]. For the framework of this study I carried out the accuracy analysis which allowed to explain the mechanism for formation of the balance errors in numerical solutions. I have shown that these errors are directly related to the numerical diffusion generated during the solution of nonlinear equation written using incorrect form. As a result, the balance errors depend on the numerical parameters such as the length of the time and spatial step and on the rate of propagation of flood wave. For this reason, the relationship between the numerical errors and improper conservative form of equation causes that the balance errors occur not only in solutions containing discontinuities, e.g. during the simulation of dam-break induced flow, but also in the continuous solutions which are affected by numerical diffusion.

5. Description of other scientific achievements

a. Before obtaining PhD degree

In 1998 I graduated from the Faculty of Environmental Engineering of the Gdańsk University of Technology. My Master thesis *Determination of parameters for flood wave equations based on the hydraulic model studies* was prepared under the supervision of dr. Teresa Jarzębińska. The subject of this thesis concerned identification and verification of parameters in the Reitz-Kreps equations describing the shape of the flood wave. This study was carried out on the basis of hydrographs of flood waves that were recorded on a hydraulic model of cascade reservoirs. The results of the study were published in the conference proceedings of XIX National School of Hydraulics (Frombork, 1999) [II.E.9].

In1999, I started working as an assistant at the Institute of Hydroengineering of the Polish Academy of Sciences (IBW PAN). My first research topic concerned the development of an algorithm for identifying of the roughness parameters in equations describing an unsteady flow in open channels and shallow reservoirs. The study focused on the one-dimensional Saint-Venant and two-dimensional shallow water equations which were solved by means of the finite element method. The identification process of parameters was treated as the inverse problem, where unknown values of roughness coefficient were determined using the optimization methods in the form of the Powell algorithm, the conjugate gradient method and the genetic algorithm. In the framework of this task I developed my own computer code realizing the solution of the unsteady flow equations as well as the optimization algorithms. The results of study were presented in internal works of the Institute of Hydroengineering [II.F.2, II.F.3] as well as were published in conference proceedings [II.E.10, II.E.11]. My research was also appreciated on XXII National School of Hydraulics, where I received the young scientists award for the best paper entitled *Identification of the roughness parameters in equations describing the unsteady flow with ice cover*.

At the same time I acquired experience in field and laboratory measurements as well as in analysis of the results of these measurements.

- In 1999, I participated in the surveys in the Gulf of Gdansk, which were carried out in the framework of the POLRODEX'99 experiment. The measurements of vertical distributions of temperature and salinity as well as the observations of the transport of a non-degradable tracer were applied to verify the hydrodynamic model for the Gulf of Gdansk developed by the Institute of Oceanography of the University of Gdańsk and at the Institute of Hydroengineering of the Polish Academy of Sciences.
- In 2000, I participated in hydraulic model experiments prepared under the supervision of dr. Ewa Jasińska and prof. Wojciech Majewski. These studies were carried out for the Maritime Office in Szczecin and concerned determination of the impact of the Oder estuary hydrodynamics on existing and planned hydro-technical development of the fairway Swinoujscie - Szczecin. My contribution to the organization of the experimental setup has been appreciated in the form of the Director of the Institute of Hydroengineering award.
- In 2003, I participated in the research group performing an expert opinion for the Regional Water Management in Gdansk. The research concerned modernization of the Vistula river outlet. The results of analysis have been published in national conference proceedings of XXIII National School of Hydraulics [II.E.12] as well as in the proceedings of the international conference *Coastal Engineering 2004* [II.A.1].

My scientific development was significantly influenced by the cooperation with prof. Romuald Szymkiewicz who was supervised my PhD dissertation entitled *Mass and momentum balance in numerical solutions of simplified flood routing models*. The aim of this work was an explanation of computational problems related to the simplified flood routing models described by means of one-dimensional nonlinear transport equations. The study has focused on the kinematic and diffusive wave model as well as on the Muskingum model.

The simplified flood routing models can be written as a system of equations or as a single transport equation. Both types of model are derived under the same main assumptions. However, each of these models is fundamentally different in its nature. The results of numerical experiments show that the models in the form of transport equations are not consistent with the mass and momentum conservation principles. This feature is particularly apparent in the case of non-linear diffusion wave equation, where the relative error of the mass balance can achieve a value up to tens percent. On the basis of theoretical analysis and numerical experiments I proved that the mass and momentum balance errors in the simplified nonlinear equations are caused by improper forms of these equations. It was found that the standard way of derivation of kinematic and diffusive wave equation leads to a non-conservative form, which does not guarantee the correct solution in terms of mass and momentum balance. In the work I proposed appropriate conservative forms of equations, describing the kinematic wave model and the Muskingum model, which cause the elimination of the balance errors and improve the accuracy of the resulting solution. Moreover, I have shown that the classical way of derivation of the diffusion wave equation, with the discharge as dependent variable, leads to a nonconservative form of this equation which does not satisfy the mass conservation principle. Such non-conservative form of the transport equation can not be directly transformed into a conservative form and consequently, the balance errors cannot be avoided in numerical solution. The proper form of the non-linear diffusion wave equation, (in terms of fulfillment of the basic principles) can be obtained only in the way of additional assumptions.

b. After obtaining PhD degree

After PhD defence, in June 2006, I continued working at the Institute of Hydroengineering of the Polish Academy of Sciences, where I was employed as assistant professor until 31 January 2008. During this period, I continued, together with prof. Romuald Szymkiewicz, research under one-dimensional simplified flood routing models. The results of study are presented in two publications: research article [II.A.2] and monographic work published in a series of Committee of Water Management, Polish Academy of Sciences [II.E.1]. Further studies related to the discussed problem I already carried out own. Results were presented in publications [II.E.2] and [II.E.3]. It should be emphasized that the problem of conservative properties in hydrological models described by simplified nonlinear equations is still a subject of interest to researchers. This is evidenced by numerous publications in journals (e.g. [7], [8], [9] and [10]). In the case of one of the works [10], associated closely with this topic, I participate in the public discussion involving conservative and non-conservative forms of nonlinear diffusion wave equation. This discussion was published as paper in 2015 in *Journal of Hydraulic Engineering* [II.A.3].

A summary of my research related to the impact of the simplifications applied in the one-dimensional nonlinear open channel flow equations I also presented as a co-author of a chapter in international monograph (II.A.4).

In 2006-2007, I participated in a research project, commissioned by the Ministry Science and Higher Education. The project concerned the analysis of hydro- and litho-dynamics processes in the zone of the Vistula Spit. In the framework of study, the impact of a planned construction of a canal through the Vistula Spit on the coastline was investigated. Additionally, an assessment of the rate of silting of the navigable canal for section from the planned ditch to the port of Elblag was carried out. During this project, I participated in the surveys in the Vistula Lagoon as well as I developed a numerical algorithm for solving of an equation of sediment transport in the coastal zone [II.J.1].

Since February 2008, I am employed as an assistant professor at the Department of Hydraulic Engineering, Faculty of Civil and Environmental Engineering, Gdańsk University of Technology. In this period, except the researches directly related to scientific achievement, I focused on preparing the book entitled *Principles of dynamic hydrology* (*Podstawy hydrologii dynamicznej*) [II.E.4]. This book is dedicated to the description and modeling of the water flow processes in hydrological systems described by equations of mathematical physics. It presents various forms of water flow including phenomena such as evaporation, precipitation, infiltration and movement of groundwater, flood wave propagation and overland flow. The textbook was also expanded to include the topics related to the transport of sediment in rivers and reservoirs as well as the thermal processes in rivers and lakes. For this book, in 2010, I received the Rector of Gdańsk University of Technology award for the outstanding achievements in teaching.

In the years 2013-2014, my work was related with hydraulic and hydrological studies of the lower Vistula River for assessing the impact of maintenance of floodplains on water level during maximum discharges. In order to determine the water level on the Vistula River from Włocławek cross-section to Toruń cross-section the steady gradually varied flow model was used. The results of hydraulic calculations, published in the paper [II.E.5], showed that the reduction of roughness of floodplains to the values corresponding to well-maintained areas between levees would result in a significant decrease in maximum water levels. Consequently, a proper maintenance of floodplains leads to an improvement of the security of the areas adjacent to the river.

During this period I also participated in the expert opinion (for the Energa Invest SA) concerned a preliminary assessment of the impact of the potential construction of cascade dams on the flow conditions in the lower Vistula River [II.F.9]. The main objective of the study was to verify the fulfilment of the requirements relating to the flood protection, safety of the Wlocławek dam and the use of the lower Vistula for the international waterway and the hydroelectric generation. Analysis was performed for the current state of hydro-technical development as well as under the conditions with planned cascade of dams. For this reason, the hydraulic model for steady and unsteady flow conditions was developed. Based on the results obtained from the hydraulic and hydrologic calculations, the assessment of the average annual energy production of the cascade was carried out. The examples of calculations were published in papers [II.E.6] and [II.E.7]. The results of analysis showed that the construction of cascade dams is a necessary technical solution which on the one hand enables the comprehensive use of waterway and hydropower potential of the lower Vistula River, and on the other it reduces flood risk and eliminates the danger related with the Włoclawek dam failure.

Currently I participate in an international project entitled *Models for coupled surface and subsurface flow on flooded areas and wetlands* [II.J.2]. This project is carried out in the framework of the scientific and technical cooperation between the government of Poland and the government of the Republic of China. Project is led by prof. Romuald Szymkiewicz of the Faculty of Civil and Environmental Engineering (Gdańsk University of Technology) and prof. Suiliang Huang, (Nankai University, College of Environmental Science and Engineering). Duration of the project covers the period from 2015 until 2017. In the project I participate in the development of a coupled model of unsteady flow over floodplain with the model of the groundwater flow.

In summary, my activity after obtaining PhD degree includes 2006-2016. During this period I published (except the publications involving the scientific achievement (Table 1)) a total of 11 works (Table 2), including 2 articles for journals and 1 chapter in international monograph indexed in the Journal Citation Reports (JCR) [II.A.2-4], 5 articles for other journals (not included in the JCR database) [II.E.2-3, II.E.5-8], 1 book [II.E.4] and 1 monograph [II.E.1]. Sum of Impact Factors (IF) for the published papers comprising other scientific achievements takes IF = 4.529, whereas a total score (according to the MSHE) is 163 points. Taking into account the contribution of co-authors, the Impact Factor and score to the MSHE take values 3.711 and 112,4, respectively.

The final resume of my scientific activity indicates that sum of Impact Factors for all papers is equal to 14,244, and taking into account the percentile contribution of co-authors it takes 11,944. Moreover, for all publications a total score (to the MSHE) is equal to 333, and with contribution of co-authors it gives 260 points. According to the Web of Science database, the number of citations associated with these publications amounts 15 (including 6 self-citations), whereas the Hirsch index takes value 3. However, the number of citations according to the Google Scholar amounts 44 with Hirsch index 4.

Table 2. Sum of the publications after obtaining PhD degree with corresponding percentile contribution of author and values of Impact Factor and number of points (according to the MSHE).

Publication	IF	Number of points (MSHE)	Percentile contribution [%]	Taking over contribution of author	
				IF	Number of points (MSHE)
II.A.2	3.271	45	75	2.453	33.75
II.A.3	1.258	35	100	1.258	35
II.A.4	0	15	40	0	3.3
II.E.1	0	20	60	0	12
II.E.2	0	9	100	0	9
II.E.3	0	4	100	0	4
II.E.4	0	20	50	0	10
II.E.5	0	6	50	0	3
II.E.6	0	3	20	0	0.6
II.E.7	0	6	40	0	2.4
II.E.8	0	0	100	0	0
SUM	**4.529**	**163**		**3.711**	**112.4**

Teaching activities and popularization of science

Since 2008, I started to lecture, at the Faculty of Civil and Environmental Engineering Gdańsk University of Technology, on the following courses [III.I.2]:

- Flood Protection – lecture and exercises,
- Meteorology and Climatology – lecture and exercises,
- Hydraulic Structures – exercises,
- Hydrology – laboratory exercises,
- Fluid Mechanics – exercises,
- Hydraulics – laboratory exercises,
- Computer Methods – laboratory exercises.

As part of the post-graduate *Modern methods of engineering hydrology in water ma*nagement I give classes on:

- Modeling of runoff process and flood wave propagation in open channels - lecture and exercises,
- Sediment transport in open channels - lecture and exercises.

In addition, since 2011, I am also the coordinator of the hydraulic and hydrochemistry practices for students at the Faculty of Civil and Environmental Engineering, Gdańsk University of Technology.

I have supervised of the six undergraduate and graduate students' theses [III.J]. Moreover, since 2014, I became a co-supervisor of PhD thesis entitled *Hydrodynamic inundation model of urban terrain equipped with rainwater drainage systems*. The work is carried out by graduate student Jakub Hakiel under the supervision of prof. Michał Szydłowski.

In 2006-2007 I participated in organization of the event popularizing science in the framework of "*Bałtycki Festiwal Nauki*" in 2006-2007 at the Institute of Hydroengineering of the Polish Academy of Sciences.

Gąsiorowski

References

Papers authored or co-authored by me are listed in Appendix 5.

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[8] Perumal M., Price R. K. (2013) *A fully mass conservative variable parameter McCarthy–Muskingum method: Theory and verification*, Journal of Hydrology, 502, 89–102.

[9] Reggiani P., Todini E., Meißner D. (2014) *A conservative flow routing formulation: Déjá vu and the variable-parameter Muskingum method revisited*, Journal of Hydrology, 519, 1506–1515.

[10] Hasanvand K., Hashemi M.R., Abedini M.J. (2014) Development of an Accurate Time integration Technique for the Assessment of Q-Based versus h-Based Formulations of the Diffusion Wave Equation for Flow Routing, Journal of Hydraulic Engineering,139, 10, 1079-1088.