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on the occasion of his 70th anniversary



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Abstract

This article presents professional activity of Krzysztof Jesionek within the background of his personal career in the field of heat and power engineering on Wrocław University of Technology. In particular, we present stages of scientific and professional development with an emphasis on nature Professor Jesionek's career main driving forces as a result of his cooperation with industry and power engineering.

Keywords: Steam and gas turbine; Power boiler; Compressors; Fluid-flow machinery; Power plants

1 Introduction

It's a pleasure for us to introduce readers of Transactions IFFM a person of Professor Krzysztof Jesionek whose 70's birthday anniversary we celebrate today. For most of us he is known as excellent teacher from Wrocław University of Technology, great researcher on steam and gas turbine, designer of power equipment, proficient in compressors and experienced expert in the field of building and maintenance machines.

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His professional career and personality development perfectly illustrates history of the national science transformations and history of cooperation with professional power plants and energy industry.

2 Personal career

The beginnings of Krzysztof Jesionek's activity reach back the time of Second World War. He was born on 26th of June 1944 in Dzierzkowice (district Kraśnik lubelski, Fig. 1) where in 1957 has graduated Primary School (Fig. 2). While developing his interest he has studied in Mechanical High School in Kraśnik Fabryczny. In 1962 he has passed a high school diploma of mechanics with specialty of 'Machining'. Over there he has had first experience in profession of designer because before started University he had worked for 2 holiday months in Factory of Metal Products in Kraśnik. In years 1962–68 K.J. Jesionek has been studying



Figure 1. Professor Jesionek with his parents and little brother in Dzierzkowice.

on Faculty of Mechanical and Power Engineering in Wrocław University of Technology (Figs. 3 and 4). Basing on work performed under Head of Steam Boilers Department – Professor Teodor Wróblewski (the first Dean of Mechanical and Power Engineering Faculty) he had reached master's degree in mechanical engineering. The first scientific experience he had gained in Department of Machine Design next to Professor Tadeusz Demeter from Faculty of Mechanics. It was



Figure 2. As an actor of puppet theater in primary school.

amazing time for scientific activity of J. Jesionek who several time had been taking a part in seminars about base construction organized regularly by Professor Janusz Dietrich in Silesian University of Technology in Gliwice.

In 1970 he came back to work in Heat Turbine and Compressor Chair transformed into Heat Turbine and Compressor Department while reorganizing the Faculty of Mechanical and Power Engineering. This department was a part of created Institute of Heat Engineering and Fluid Mechanics I-20. He had been working here continuously to 2001 to the moment of next reorganization when there has been opened Department of Fluid-Flow Machinery (under the direction of Professor Janusz Plutecki). From 2005 Professor Jesionek has been head of Boilers and Turbines Department in I-20 Institute.

While working as educational and science assistant he has been extending his knowledge in Doctoral Study for working people established at Faculty of Mechanical and Power Engineering. In 1975 after thesis 'Effects of inlet velocity field vorticity on aerodynamic performance of curved subsonic diffusers', Educational and Science Council of Institute of Heat Engineering and Fluid Mechanics has granted him a PhD degree in technical sciences. Based on habilitation thesis 'Forecasting of flow separation and possibility to its limit in power machines' in 1998 Council of Mechanical and Power Engineering Faculty has granted him a postdoctoral degree in technical sciences. By order from 22nd of October 2007 President of Republic of Poland Lech Kaczyński has granted him the title of professor of technical science and from 2011 Wrocław University of Technology has hired him as full Professor.



Figure 3. First year of study at University – in the 8-person dorn.



Figure 4. Collage times – somewhere in Sudeten.

3 Scientific experience

Researcher's professional life is partly result of direct contact with research center. This result can be different – in some cases nonmobilizing, in other case efficacious. Professor Jesionek has had a big luck – by 9 months (1983/84) he had been working in Moscow Power Engineering Institute (MPEI) in Steam and Gas Turbine Chair in Department of Aerodynamics of Gases under the direction of Professor Michail E. Dejcz and in Department of Diffuser Flows under the direction of Professor Arkadiy E. Zaryankin. He had attended to lectures of Professors: Michail E. Dejcz, Borys M. Trojanowski and Arkadiy E. Zaryankin. This scientific contact has become leading contact – later in next years he several times stayed in MPEI (for one month (1986) and about 15 one- or two-weeks internships in years 1988–2009).

During the first visit in MPEI he's got familiar with unique offices in laboratory of gas dynamics which, from only few in the world, test stands are powered by steam (Fig. 5). He has also recognized original achievements of Professor Dejcz's school and has met with nowadays problems with designing and utilization, especially those parts of fluid-flow machinery which have positive values of along static pressure gradient. During these visits in 1992 he led to the signing official agreement of scientific cooperation (I-20/343/92) between Steam and Gas Turbine Chair MPEI and Turbomachinery Department of I-20.



Figure 5. With academical students in MEI Professor Arkadij E. Zaryankin.

The former effect of cooperation (mutual visits by employees, students exchange, possibility to using great MPEI laboratory) with known in the world

partner are two joint studies and over forty common publications. Especially, cooperation with Professor Zaryankin has resulted in numerous important publications.

Professor Jesionek's scientific interest was also partnership with research centers in Romania, like: Iasi – Technical University (two 10-days internships, 2001 and 2002), Bucharest – COMOTI – National Research and Design Institute for Turboengines (two 14-days internships, 1998 and 2000). Cooperation subject (with Romanian researchers) seemed very current and was about using of air turbines in nowadays industrial power. It effected in writing two publication in international conference proceedings (Micolc University of Technology – 2001 and Lwów University of Technology – 2001), three national proceedings and PhD thesis of Tomasz Toporski, defended in January 2004.

4 Industrial experience

Experience with working direct with fluid-flow machine is extremely valuable. In 1990 Krzysztof Jesionek has held six-month industrial intership in the Cement and Lime Combine Warta in Działoszyn where he has been creating and utilizing fans, blowers and compressors. The choice of the Combine was conducted by possibility to implementation a new construction of exhaust fan (with engine power 1000 kW) designed by and under the direction of Professor Jesionek under CPBR No. 11.2 aim No. 79. This fan is operated on first 'thread' of cement in frame of research program Warta II.

5 Scientific activity

Scientific achievements of Professor Jesionek are enormous – over 200 published positions, including about 60 in English and 2 in Russian. In addition to this he is an author or coauthor of over 120 unpublished research works which part of has been used in industrial or laboratory practice, something about 60 undocumented develop and opinions about causes of machinery failure and power equipment (fundamental for author's lecture 'Analyzes of turbomachinery and devices failures') and about 100 kind of reviews.

In December 2009 there has been published a monograph 'Combined air/steam power plants' authors : J. Goliński, K. Jesionek published by The Szewalski Institute of Fluid-Flow Machinery of the Polish Academy of Sciences in Gdańsk as 31st volume (Fig. 6) of renowned series 'Fluid-Flow Machinery' ('Maszyny Przepływowe'). This 426-paged monography is the biggest volume publication presented original thermodynamic cycle called the Goliński-Jesionek cycle.

Professor Jesionek has initiated and conducted many team studies. Many of

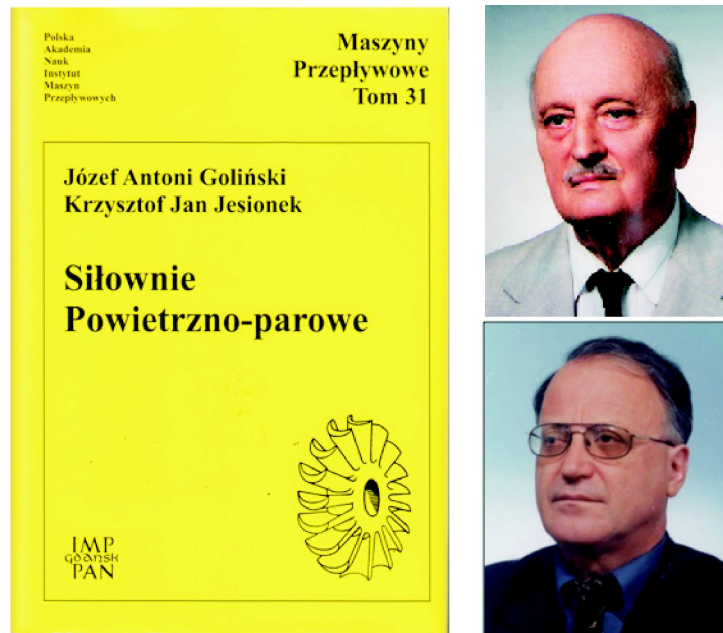


Figure 6. Professor Józef A. Goliński and Professor Jesionek.

these studies results was refereed on national and foreign symposia, conferences and seminars.

In regard research activity range is reflection of national heat and power engineering problems and it included follow areas concerning machinery and power equipment:

- utylizational research and expertise, model testing machines and fluid-flow devices,
- structural issues and designing about fluid-flow machinery and devices,
- utylizational problems with heat machinery and devices
- research of phenomenon and process during fluid flow in elements of machinery and installation,
- analyzes of fluid flow, especially in field of positive values of along static pressure gradient,
- gas-steam system of heat power station taking into account binary over station.

In the initial period of his research activity Professor Jesionek has been dealing with problems with using of combustion chamber to counter jet mill drive and

with using of numerical electronics in research and designing fluid-flow machinery. After getting some practice concerning laboratory research and on industrial devices turned his interest to the issue of automating the measurements of rotating machinery and fluid-flow installation. In last few years he also dealt with issues of gas-steam systems – especially binary power houses – continuing this way scientific activity which started in Poland by Professor Józef Goliński.

6 Crucial projects

Professor Jesionek is originator and director of several of research project which are significant for heat and power engineering:

1. In years 1977–1981 he was directing after the subject ‘Influence of vector’s rotation field of inlet velocity on curved diffuser aerodynamic performance’, performed under interdepartmental program MR.I.10 ‘Optymalization of thermodynamic and fluid-flow process’ in order of Institute of of Thermal and Combustion Engines of the Poznań University of Technology.
2. Under Polish research program CPBR (National Project of Research and Development) No. 11.2 ‘Technique of air protect’, in order of OBR (Industry Department of Research and Development) ‘Barowent’ in Katowice, in years 1986–1990 purpose No. 79 titled ‘Centrifugal exhaust fans for cement industry’. During realization of this subject it performed parameters research of exhaust fans, which had been used in every national cements. During analyzing this way results there took into consideration planning necessities of modernizing and already-designed plants. He conducted inspection of national produced fans and basing on this worked out assumptions for a new series of types of exhaust fans for cement industry. He designed and performed experimental office in purpose to centrifugal exhaust fans research. He made two series of experimental researches of model rotor. In base of this way analyzes results he suggested a new series of types of exhaust fans for cement industry. First designed construction in this research program (with engine power 1000 kW) proceeded only in modernizing Cement Warta II in Działoszyno, because privatization of cement had caused interrupting its activity.
3. Under Polish research program CPBR No. 4.2/41.1.5. ‘Technology and basic machinery and devices for clinker burning node in dry process...’, in order of Institute of Mineral Building Materials in Opole, he performed in years 1989–1990 two studies about exhaust fans from ‘thread’ system in Cement which uses dry process:

- a) basing on analyzes assumed conditions of fan work, fluid-flow calculations, resistance and performed modeling researchers, he made preliminary scheme of exhaust fan from rotary kiln,
 - b) because of upgrading Cement Nowina II has developed, based on further testing of the model detailed technical documentation of all components of the exhaust fan with the aforementioned rotary kiln. He worked here from the design office of Factory Fans FAWENT.
4. In years 1999–2002 he was directing two big studies for Power Station Turów concerning analyzes of working recovery system on power units No. 8, 10 and research leading to explain the causes of unbalanced work of two parts of capacitor on these power units. This research results are presented in eight series Reports and in two publications.
 5. In years 2003–2006 he was directing big study for Power Plant Bełchatów titled ‘Analyze of causes of corrosion and erosion of turbine components in terms of the methods used to prepare the water in the circuit steam-water block’. He designed and supervised the implementation of the, unique on a global scale, research office (installed on the power unit No. 3) to research model phenomena of erosion and corrosion the steam turbine control valves in terms of the methods used to prepare the boiler water – oxygenating water in ‘Combi’ system. Inlet steam parameters: 18 MPa i 535 °C. He presented these research results in six series reports and in four publications.

7 New turboengines

Reaching back to 1999 Professor Jesionek dealt with the issues of using of aircraft engines after TBO in industrial power. In this purpose he made contact with Iasi University of Technology, Bucharest University of Technology, COMOTI from Bucharest (National Research & Design Institute for Turboengines). Those contacts reached to nowadays CSWLI in Oleśnica and Motor Sicz Plant in Ukraine. While 4 short internships in Romania (Iasi and Bucharest) there has been implemented similar project. Within the framework of this project it managed to gain and examine two smooth engines. However because of problems with gaining smooth engine TW3-117 (with power 1000 kW, which has a chance to be used in one of sugar factory in Silesian) and no funds this program has been suspended – though engines with small power GTD-350 and Ai-9 are prepared in office stands in a laboratory.

Activity in this area effects in writing a PhD thesis (Tomasz Toporski), 5 publications and papers presented in national and international conferences. Now it's

preparing a project of ‘Hydrogen Turbine’ (based on engine GTD-350), which purpose of is PhD thesis and implementation this technology in Chemical Engineering Industry Rokita in Brzeg Dolny, where significant surplus of secondary hydrogen production are nowadays disposed of by combustion in the furnace burners.

8 Industrial inquiries

One of the area where Professor Jesionek completely showed his research talent is expertise of contribution of electrical devices breakdown. He has made over 30 expertises about explaining contribution of fans, compressors, boilers and gas and steam turbines breakdown – on behalf of the heat and power plant, courts of justice or insurance company.

9 Professionals opinions

There are numerous of scientific reviews articles and research projects and also theses and habilitation monographs. Professor Jesionek is a member of scientific committees or recurring abroad conferences council:

1. ‘Effective production, transmission and consumption of energy’ – Technical University of Kosice, Faculty of Mechanical Engineering.
2. ‘Effective production, transmission and consumption of energy’ – ‘Stiinta Moderna si Energia – Producea, Transportul si Utilizarea Energiei’ – Universita Technica din Cluj-Napoca, Facultatea de Instalatii – vice-chairman of conference.
3. ‘Conferinta Internationala Turbo’ – COMOTI Bucuresti,

and over 100 national conferences.

10 Recent achievements

As a result of financing status activities and financing by KBN (State Committee for Scientific Research), in recent years research activity largely focused on scientific cooperating with Steam and Gas Turbine Chair of MPEI, based on its laboratory equipment. This cooperating resulted in few of joint publications.

Recent research subjects developing by Professor Jesionek describe follow fields:

- a) research and theoretical analyzes of different kind of positive (diffusion’s) flow values of along static pressure gradient, improvement of energy machinery and devices pieces work;

- b) research designing problems with heat fluid-flow machinery – axial and radial fans, blowers, compressors and gas and steam turbines;
- c) research and theoretical analyzes of different kind of gas-steam system, especially hierarchical system of power stations (also with using of turbine aviation engines in industrial power engineering), binary system and Cheng system.

Especially the first – from mentioned above – field is close to him, because whole professional life, from PhD thesis though most of internships in MPEI, right to dissertation and monographs were focused on this, though recent years are related with problem with hierarchical system heat power stations (2 books about that).

11 Results of dissemination activities

Professor Jesionek's papers we can read in magazines:

- VDI Berichte,
- Acta Mechanica Slovaca,
- Systems, Journal of Transdisciplinary System Science,
- Acta Metalurgica Slovaca,
- Power Engineering (in Polish),
- Ventilation, Air-Conditioning, Heating Technology, Health (in Polish),
- Journal of Computational and Applied Mechanics,
- Vestnik MPEI,
- Transactions of the Institute of Fluid-Flow Machinery,
- Installer (Journal of Plant Engineers Association of Romania),
- Chemical and Process Engineering (in Polish),
- Archive of Combustion,
- Measurement, Automation, Control (in Polish),
- Pumps Valves and Systems Magazine (in India),
- Thermal and Professional Energy.

He submitted scientific papers for national and many international conferences held in the countries like: USA, USSR, Czechoslovakia, Germany, Romania, Russian Federation, Hungary, Turkey, Bulgaria, Syria, Slovakia, Czech Republic, Republic of South Africa, Belgium, China and Ukraine (Figs. 7–9).



Figure 7. Cape Point September 2007 (Republic of South Africa).



Figure 8. Grand Canyon National Park September 2009 (USA).



Figure 9. Great Wall September 2013 (China).

12 Didactic activity

Professor Jesionek's teacher activity is related with educating students specialization in thermal engineering or specialization in flow-fluid machinery on Department of Mechanical and Power Engineering, in subject about: fluid-flow mechanics and turbomachinery. He gave many kinds of classes: lectures, auditorium and laboratory exercises, designing exercises, seminars, thesis seminars, controlled own work and transition piece work, individual projects and theses.

So far he has led lectures on the following subjects:

- designing a flows,
- selected issues of gas dynamics in fluid-flow machinery,
- fluid mechanics – selected issues,
- heat turbomachines,
- energy machinery and equipment,
- steam turbines,
- vibrations of turbomachines,
- turbine regulation,
- condensational devices,
- condensers and cold stores,
- piston compressor
- automation of power units,
- technology of manufacturing and installation of turbines,
- diagnostics of turbomachinery,
- regulation and automation of turbine.

Presently he is leading lectures on following subjects:

- heat fluid-flow machinery,
- turbines in gas-steam systems,
- special turbine constructions,
- analysis of turbomachinery and devices failures,

and diploma seminars in intra- and extramural studies.

It's good to mention about lecture 'Flow with ablation' for PhD students. Under the direction of Professor Jesionek there were made over 200 theses and about 50 engineering diplomas in specialization thermal power engineering in field of study fluid-flow machinery. Very important Professor Jesionek's classes are his lectures in evening collage for working, in postgraduate study 'Turbomachinery and devices' and at Technical School, organized by Faculty of Mechanical and Power Engineering. For one year he had also given lectures and designing classes in branch of Wrocław University of Technology in Legnica and and for over one year in branch in Wałbrzych. For three years (2001–2003) he had given lectures and classes on 'Fluid mechanics and thermodynamics' in School of Management in Legnica.

Professor Jesionek don't ignore drudgery like preparing learning materials, more one he is coauthor of two scripts. He initiated entering laboratory 'Fluid-flow machinery' (7 office stands) initially related with the course 'Fluid mechanics – selected issues' and presently (as a side effect of the implementation of the Bologna process) it is provided to restarting as part of planing Departmental Laboratory of Fluid-Flow Machinery.

In the academic year 2009/2010, Professor Jesionek has put a lot of effort to invent author's lecture titled 'Analysis of energy machines breakdown' which isn't only theoretic knowledge, but is based on author's experience. Student had unique possibility to cognize extended Professor Jesionek's knowledge in issues which he took part directly and which happened on specific energy objects – in powerhouses, heat and power plants, industrial power plants, insurance and judiciary associations.

Professor Jesionek actively participated in LLP-Erasmus Program by giving lectures about hierarchical systems of heat power station and steam-injected gas turbine system at Universities of Technology: TU of Cluj-Napoca, TU Košice, G.H. Asachi TU of Iasi, University of Ruse, University 'Politehnica' of Bucharest.

Another form of activity is training for engineers. Right here Professor Jesionek led training in terms of heat fluid-flow machinery in order of Polish Society of Power Engineering Engineers (SPE) to give legal energy permission for individuals supervision and individuals operation, individuals operation of networks and heat devices and installation *inter alia* in Chemical Plants: Rokita (Brzeg

Dolny), Wizów (Bolesławiec), Kedzierzyn-Koźle, in Predom-Polar Plants and in BIAP Company in Wrocław.

Professor Jesionek always wants and is able to have good relation with young researcher. He promoted four PhD theses and now he is promoter of four PhD theses (Fig. 10). Two another ones are in the initial phase .

13 Organization activity

In last thirty years Professor Jesionek several times was a head of different sizes research teams (from 2 to 10 people) organized to solve different kinds of scientific, technical and research problems. *Inter alia* he led instituted seminar titled 'Fluid-flow machinery and devices' (for departments: Fluid Mechanics, Base Construction of Power Engineering Equipment and Heat Turbines and Compressors) and scientific seminary in fluid-flow machinery.

He was also Deputy Editor of instituted publications and adviser to specialized fluid-flow machinery courses. At first in years 1988-1994 he replaced the head of Department and later in 1995-2001 he was the head of Heat Turbine and Compressor Department. From 2006 he has served as the head of Boilers and Turbines Department in Institute I-20 (Fig. 10).



Figure 10. Professor Jesionek with PhD students and workers from Boilers and Turbines Department.

14 Others activity

Professor Jesionek is coorganizer of the popular and well-known postgraduate studies „Modern technologies in energy machinery repairs”. On behalf of the Polish Society of Power Engineering Engineers (SPE), in last three years he organized for students of fifth year trainings on energy powers permission.

Fulfilling his academical duties, he several times took a part in diverse examination committees and recruitments performed in high schools – mostly in the area of Silesia and in exams-coming organizations.

Professor Jesionek devotedly directed work of diploma examination committees for specialization fluid-flow machinery. Presently he is leading diploma examination committees for specialization thermal power engineering and diploma examination committees of extramural studies. He is known for students and graduates – being a guardian of student’s groups, he shared in teaching and educational process. He chaired many of professional internships, *inter alia* in Steelworks in Ukraine Żdanowo (presently Mariupol), Konin Power Plants PAK, Pałnów Power Plant and in Wrocław (Plants of Predom-Polar). He also led exchanged practices abroad, centrally organized.

Under the cooperation contract with MPEI and with the support of State Committee for scientific Research (KBN), since 90’s in 4 years he had organized students exchange (in 2/3-person groups) from specialization fluid-flow machinery and short internships in Moscow and Wrocław. Due to the fact that educational work is related with tourist activity, after several years functioning with university students Professor Jesionek was constantly trying to get the appropriate qualification in this field – he got permission of Sudeten mountain guide, off-road guide in Lower Silesia, GOT’s (Mountains Tourists Badge) tourist mountain guide, touring instructor, social care after monuments instructor, PTTK (Polish Tourist and Sightseeing Society) lecturer, tourism organizer and in PZMOT (Polish Motoring Association) – car tourism instructor and road lifeguard.

15 Social activity

In recognition of his merit, Professor Jesionek was several time chosen to scientific and social body. He is a member of Metrology Commission of Bureau Branch of the Polish Academy of Science in Katowice. He has the authority (No. 098) expert-auditor of Polish Society of Power Engineering Engineers. He is active member of Qualification Commission established on 18th of October 2002 by President of the Energy Regulatory Office. He is also a member of Polish Society of Power Engineering Engineers and Technicians Association (SIMP), Polish Society of Power Engineering Engineers (SPE) and Polish Theoretical and Applied

Mechanics Association (PTMTS) where in periods 2002–2004 and 2005–2010 was in Branch-Board of Wrocław.

It is necessary to point that, without any influence on professional activity, in 1986 as Vice-President of Provincial Committee of Tourism PTTK (1984–88) and cooperating with Polish Academy of Sciences branch in Wrocław, Wrocław University of Technology, University of Wrocław and Provincial Office, he organized two-days symposium which ended by printing materials ‘*People of science and their relation with Wrocław*’ (PTTK and Provincial Office, Wrocław 1986) with memorizing their masters known (*inter alia* Ludwik Hirszfeld, Kazimierz Idaszewski, Stanisław Kulczyński, Dionizy Smoleński, Hugon Steinhaus, Włodzimierz Trzebiatowski, Mieczysław Wolfke, etc.).

And not for the end, by almost 40 years (with little break) he was irreplaceable member of PTTK Branch Management next to Wrocław University of Technology. Presently functions as Vice President of Tourist Guides Circle of PTTK Branch – Wrocław-Fabryczna sharing his experience and advice with younger friends.

16 Honours

In recognition of his merits for science development of city Wrocław and Wrocław University of Technology, Professor Krzysztof Jan Jesionek reached a number of honors and awards, *inter alia*:

Gold Cross of Merit
Medal of the National Education Commission
Gold Medal for Long Service
Gold Badge Wrocław University of Technology
Gold Badge of Honour PTTK
Gold Badge of Honour PTTK Wrocław Psie Pole
Golden Bagde of the Society of Friends of Wrocław
Silver Badge of Honour PTTK
Silver Bagde of the Society of Friends of Wrocław
Silver Bagde of PTMTS

For achievements in scientific research, teaching and education work he several times reached Wrocław University of Technology Rector Award, Faculty of Mechanical and Power Engineering Dean Award, Institute of Heat Engineering and Fluid Mechanics Director Award and governor of Wrocław diplomas. Recently he was awarded the prestigious „Docendo Discimus” by Rector of Wrocław University of Technology for outstanding achievements in teaching.

17 Congratulations

On behalf of the authorities, superiors, colleagues and all co-operating with industry, thanking for effort and amazing witness of researcher's life, we fold Professor Krzysztof Jesionek best birthday wishes – *sto lat Krzysztofie!*

Janusz Lewandowski
Zbigniew Gnutek
Janusz Badur