INSTITUTE OF FLUID-FLOW MACHINERY
POLISH ACADEMY OF SCIENCES

TRANSACTIONS OF THE INSTITUTE OF FLUID-FLOW MACHINERY

109

Selected papers from the National Seminar devoted to 60th birthday anniversary of Professor Jarosław Mikielewicz, Gdańsk, Poland, April 10th, 2001

WYDAWNICTWO IMP PAN

GDAŃSK 2001

EDITORIAL AND PUBLISHING OFFICE

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Financial support of publication of this journal is provided by the State Committee for Scientific Research, Warsaw, Poland

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ISSN 0079-3205

TRANSACTIONS OF THE INSTITUTE OF FLUID-FLOW MACHINERY
Appears since 1960

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Transactions of the Institute of Fluid-Flow Machinery have primarily been established to publish papers from four disciplines represented at the Institute of Fluid-Flow Machinery of Polish Academy of Sciences, such as:

- Liquid flows in hydraulic machinery including exploitation problems,
- Gas and liquid flows with heat transport, particularly two-phase flows,
- Various aspects of development of plasma and laser engineering,
- Solid mechanics, machine mechanics including exploitation problems.

The periodical, where originally were published papers describing the research conducted at the Institute, has now appeared to be the place for publication of works by authors both from Poland and abroad. A traditional scope of topics has been preserved.

Only original and written in English works are published, which represent both theoretical and applied sciences. All papers are reviewed by two independent referees.

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TRANSACTIONS OF THE INSTITUTE OF FLUID-FLOW MACHINERY
No. 109, 2001, 3-12

Professor Jarosław Mikielewicz

On his sixtieth birthday and thirty seven years at the Institute of Fluid Flow Machinery of Polish Academy of Sciences (IFFM PASci)

The profile of the celebrity

Professor Jarosław Mikielewicz was born on 10^{th} April 1941 in Vilnius. In 1945 the whole family of Mikielewicz with children moved to Gdańsk. He read his higher education courses at the Department of Machinery at Technical University of Gdańsk in the years 1959-1964, which he completed with the Master of Engineering degree. He was awarded the degree of Doctor of Philosophy in technical

sciences in 1968 by the Board of Machine Building Department at Technical University of Gdańsk for the doctoral dissertation titled *Analysis of the possibility of application of "liquid fins" in high-temperature variable-pressure recuperator.* The Doctor of Sciences degree was also conferred to him in 1972 by the Board of Machine Building Department at Technical University of Gdańsk for the dissertation titled *Selected problems of steam generation of a low-pressure boiling medium in a cycle of a two-component power unit.*

He took the placements in the area of heat transfer at the Institute of Thermal Physics of AS SSSR in Novosibirsk, Institute of Heat and Mass Transfer of AS BSSR in Mińsk, University of Delaware, University of Michigan, Massachusetts Institute of Technology in USA. In the years 1981-1982 he stayed at Brown University in USA as a Visiting Professor. In 1986 in the frame of DAAD stipend he stayed for a month at four German universities and in 1988 he stayed for a month at three American universities funded from the resources of American Academy of Sciences. In 1991 he stayed for a month in Canada invited by the McMaster University. During that stay he visited several universities as well as Canadian research centres.

* * *

Professor J. Mikielewicz started his professional carrier in 1964 and has already completed 37 years of work at various scientific positions starting with as an assistant trainee at Technical University of Gdańsk, through the posts of assistant, senior assistant, research fellow, docent and ending as a full professor at the Institute of Fluid-Flow Machinery PASci. The title of professor in technical sciences was awarded to him by the President of the State with the decree of 13 September 1979. In December 1990, based on a positive opinion from the Central Qualification Commission he was raised by the Secretary of Academy to the position of full professor. Since 1972 he was a Head of Thermodynamics and Heat Transfer Division at IFFM PASci until 1992. In 1992 he was elected by the Scientific Board of the Institute of Fluid-Flow Machinery to the post of Deputy Director for Science and in 1998 to the post of General Director of the Institute.

Apart from his scientific and research activities he conducted, since 1972, in the frame of the part time job, educational work first at the College of Engineering, Koszalin, and then at the Technical University of Gdańsk in the frame of full time, part time and contracts.

Achievements in scientific and research work

Scientific work of Prof. J. Mikielewicz has been presented in 146 published works. Major directions of his scientific activity can be outlined as follows:

- analysis of new thermodynamical power cycles,
- heat transfer in heat exchangers with the aid of new elements, such as liquid fins,
- flow boiling problems and non-isothermal liquid-vapour flows,

- evaporation in thin liquid layers,
- split of thin layers of liquid into rivulets, wetting problems,
- problems of stability of two-phase liquid-vapour flows in channels,
- critical flows of two-phase liquid-vapour mixtures,
- natural convection in a thermosyphon in application to the thermal diode,
- flooding of fuel elements during nuclear reactor incidents,
- direct contact condensation on sub-cooled liquid layer,
- spreading and heat transfer of single and two-phase jets impinging on a surface,
- analysis of non-conventional equipment and systems of energy conversion, particularly analysis of solar collectors and their implementation in domestic conditions.

Works on the topic of a new equipment for intensification of heat transfer, so called *liquid fins* have been distinguished with the award of Technical Sciences Department of PASci in 1974. Problems of boiling, two-phase flows, stability of thin liquid layers have fundamental importance in steam generators, nuclear reactors, apparatus in chemical engineering, refrigeration evaporators and many other technical applications. Developed by him semi-empirical method for calculation of heat transfer coefficients during flow boiling is widely known. It has been published in International Journal of Heat and Mass Transfer and has been cited in many sources. Another work, regarding the method of determination of characteristics of pumps operating on two-phase medium under conditions of reactor failure, where he was the principal author (of a theoretical concept), developed in the USA, has stroke a significant interest amongst specialists. The method has been discussed several times and cited. The concept proved to be correct, which has been confirmed by experimental investigations. The method has been introduced into the calculation codes for the reactor failure at the Electric Power Institute in USA.

Prof. J. Mikielewicz is also a principal author of a new mathematical model of a phenomenon of split of a liquid film into rivulets. The correctness of that model has been confirmed by experimental investigations conducted in the group headed by him, and also other authors. Developed model of wetting, where he is a co-author, is characterised by a very novel approach to the problem.

Apart from works of fundamental nature Professor J. Mikielewicz actively worked on several technical problems, amongst the others connected with realisation of experimental two-components power unit with 2 MW power contracted by ZAMECH from Elbląg, which unfortunately has not been competed, ammonia turbine utilising waste heat (Institute of Artificial Fertilisers in Puławy), steam dehydration in layered blades to reduce the impact of corrosion – ZAMECH Elbląg, systems of tank heaters on contemporary tank-ships (Shipyard of Paris Commune in Gdynia), numerous expertises for the Centre of Marine Technology in Gdańsk.

After receiving the professorship, Prof. J. Mikielewicz undertakes, together with his supervisees new complex problems such as heat transfer at supercritical pressures, flow boiling crisises, two-phase annular flows with account of a flowrate of separating and entraining droplets from the surface of liquid film, heat transfer in the presence of medium vibrations, natural circulation in closed circuits in application to so called thermal diodes. The results of these works have been in majority published in international journals. During his stay at Brown University in the USA as well as after his return he works on the problem of two-phase critical flows in channels. As a result of these works the theory of singular points in multi-dimensional space was developed. Other works regarding two-phase flows are: methods of analysis of such flows based on criteria of reversible and irreversible processes, analysis of closure problems in two-phase flows, flows through T-junctions. These problems are of fundamental importance in the development of a branch of science known as two-phase flows.

In 1986 he received an award from the Secretary of PASci for supervising the work on *Models of phenomena occurring in two-phase flows.* Recently he was also involved in complex heat transfer phenomena (convection with conduction) linked to incident flooding of fuel elements of nuclear reactors, direct contact condensation of steam on a sub-cooled liquid layer and finally the split and heat transfer of single and two-phase jets impinging on a solid surface. The model of *flooding* enables not only determination of the liquid front velocity, but also determination of the structure of two-phase flow during *flooding.* Condensation of steam on a liquid layer has been solved by him using analytical approximate method. In the model included has been a specific turbulence in the vicinity of the liquid-vapour interface. It is a novel approach to the problem, which stroke interest amongst authors in the country and abroad. In recent works he considers the split and heat transfer of the liquid layer formed due to impingement of a liquid jet or an air jet with droplets on a solid surface. He analyses the shape of the jet on inclined surface as well as conditions for transition of supercritical flow into the subcritical one (hydraulic jump) using developed earlier application of the theory of singular points.

A summary of works by Prof. J. Mikielewicz on the motion and heat transfer of thin liquid layers flowing on a solid body surface is a co-author's monograph *Motion and heat transfer of thin liquid films*, Fluid-Flow Series, Vol. 23, Ossolineum, Wrocław.

Another direction of Prof. J. Mikielewicz interest is energy conversion in non-conventional systems and apparatus, particularly utilisation of solar energy under domestic conditions. He elaborated, in the frame of that problem, a series of issues connected with implementation of flat solar collectors in agriculture. This encompassed development of simple, effective algorithms for thermal calculations of solar collectors in stationary and non- stationary states. He is a co-author of a new concept of a collector with absorption of radiant energy in the volume of semi-transparent bed. From the area of problematics connected with energy conversion in non-conventional apparatus, apart from original works Prof. J. Mikielewicz is a co-author of a monograph *Non-conventional apparatus and systems*

of energy conversion Fluid-Flow Series, Vol. 24, Ossolineum, Wrocław.

A summary of Prof. J. Mikielewicz knowledge on the topics of mass, momentum and energy transport is a monograph titled *Modelling of thermal-hydraulic phenomena*, Fluid-Flow Series, Vol. 17, Ossolineum, Wrocław 1995.

Apart from works of fundamental nature Prof. J. Mikielewicz took part, together with his group after receipt of the professorship, in several application works. Mentioned here can be the concepts: of air solar collectors utilised in agriculture for produce drying, soil heating in foil tunnels, heating of water in fish growing ponds, collectors for drying of utilisation sands using solar energy for Tomaszów Mine of Natural Resources "Biała G'ora". For the entire effort connected with implementation of solar collectors he received two group awards from the Co-ordinator of the topic PR-8. Development of the solar heating of a Mikołajów Tower, leisure centre of the Automobile Club Warsaw, belongs also to the works on the implementation of solar energy. Other applicational works encompass modernisation of a thermal-cooling system of a autoclave for "Polfa-Starogard" factory, assessment and modernisation of heat exchangers and climatisation units manufactured by "Klimor-Gdynia", utilisation of waste heat from greenhouse furnaces for production of electric energy using a freon cycle, development of production technology and investigations of heat transfer intensity of rolled tubes for refrigeration and heating applications. Recently he developed a theory of steam separators with swirlers for two-phase flows contracted out by ABB Atom from Sweden.

He took part in a series of international and national conferences presenting papers or taking an active part in discussions amongst the others in former Soviet Union, Great Britain, USA, Romania, Germany, Yugoslavia, Italy. He was invited to present his works in most prestigious research centres of former Soviet Union, USA, Great Britain, Germany, France, Canada, Sweden. He assessed works for a well known international journal – Multiphase Flow Magazine and many domestic publishing, books by prominent Polish scientists from the area of thermodynamics and heat transfer, for a Central Commission for Degrees and Titles as well as Polish Scientific Committee for Research. He is the Editor-in-Chief of the *Archives of Thermodynamics* and IFFM PASci Publishers. At present he is a Member of a Central Commission for Titles and Scientific Degrees. In 2000 he was incorporated to the Editorial Board of a prestigious British magazine *Nature*.

Development of staff and educational achievements

Under supervision of Prof. J. Mikielewicz completed have been 12 doctorate studies. He was a custodian of 6 Doctor of Science dissertations, which have been successfully completed. He assessed about 30 doctoral dissertations and several habilitational dissertations. Five doctoral works have been submitted by foreign PhD students, and one doctoral dissertation was defended at the Victoria University of Manchester, Great Britain, and one regarding the baccalaureate at the Royal Institute of Technology in Stockholm. He elaborated in the form of review

the scientific achievements of about ten candidates to the title of professor.

Apart from the scientific and research activity he conducted educational activity.

For several years he lectured at the College of Engineering in Koszalin, and then at Technical University of Gdańsk.

He conferred lectures on the Continuum Media Mechanics and widely understood Thermodynamics (Classical Thermodynamics, Thermodynamics of Irreversible Processes, Heat Transfer, Technical Thermodynamics) for students from Technical Physics and Applied Mathematics Department. A new view on classical and technical thermodynamics in application to, amongst the others, gravitational, electrostatic, magnetic fields, surface phenomena has been presented in the work *Principles of Thermodynamics* as well as in printed series on course lectures *Selected Problems of Thermo-Mechanics* and *Outline of Thermodynamics*. On the other hand, the problems of heat transfer have been presented in student books *Outline of Heat and Mass Transfer* and *Heat Transfer*. All these works are characterised by a novelty and a contemporary view. He is a supervisor of several Master of Science works. For his educational activity he received several Rector awards at the College of Engineering in Koszalin and a medal "Of merit to the College of Engineering in Koszalin", and also has been distinguished by the Koszalin district government with an Honour Medal "Of merit to the development of Koszalin district" in 1984.

He gave lectures at the doctoral course at IFFM PASci, many postgraduate courses, courses for the development of engineering staff from "Energoprojekt" Gdańsk. The result of these activities are original course notes. He led also a series of courses for young scientists, for example from the *Theory of Experiment*.

Achievements in the area of science management

Since 1972 until 1992 he led the Thermodynamics and Heat Transfer Department at the Institute of Fluid-Flow Machinery PASci. In 1992 he was elected by the IFFM PASci Scientific Board to the post of Deputy Director for Science and in 1998 – General Director.

For very many years he is a Member of the Scientific Board of the Institute of Fluid-Flow Machinery PASci. He was a Member of the Board of the Faculty of Machine Building and the Faculty of Technical Physics and Applied Mathematics of the Technical University of Gdańsk, Scientific-Technical Board of the Research Centre for Refrigeration and Gastronomy "Gastromasz", Consultation-Scientific Board at the Implementation Centre of a National Co-Operative Factory "Prodrem" in Gdańsk. He is a Member of a Scientific Board in the Centre of Marine Technology in Gdańsk and the Power Engineering Institute in Warsaw.

For the last three tenures he was a Chairman of the Committee of Thermodynamics and Combustion PASci. For his management activity he received in 1995 a Scientific-Management Award from the Secretary of IVth Department of PASci. He is also a Member of the Power Engineering Committee, Member of a Section of

Fluid Mechanics of the Committee of Mechanics PASci and a Member of Gdańsk Scientific Society. Since 1988 he is a Member of the Editorial Committee of the *Archives of Thermodynamics* and since 1993 a Member of Editorial Committee of the *Transactions of the IFFM.* In 1997 he became the Editor-in-Chief of *Archives of Thermodynamics* and since 2000 the Editor-in-Chief of *Transactions of the IFFM.*

For his scientific and management activity he received: a Gold Badge of Mechanical Engineering Department of Technical University of Gdańsk, a Silver Medal of Mechanical Engineering Department of Technical University of Łódę, Medal of 75^{th} Anniversary of Marine High School in Gdynia. In 2000 he received a medal from the society of scientists working in multiphase flows for his contributions to multiphase flows.

For two terms he was a Member of the Polish Scientific Committee for Research (KBN), and in the second term he was elected the Chairman of the Electrotechnics and Energy Group KBN (Group T10) as well as a Member of PHARE Board. He is a Polish delegate to the 5^{th} Framework Programme of EU in the Commission "Energy", a Member of a Central Commission for Titles and Scientific Degrees. In 1988 he was qualified to become an Ordinary Member of the International Refrigeration Institute in Paris.

He was an organiser of Summer Schools devoted to the problems of "Two-Phase Flows" organised in the frame of Committee of Thermodynamics and Combustion PASci in 1976 as well as in the frame of a Section of Fluid Mechanics of the Committee of Mechanics PASci.

He was a Member of the Organising Committee of International Conference titled "Baltic Heat Transfer Conference", Göteborg 1991, and in 1999 he was awarded organisation of that conference in Poland. In 1997 he was an organiser of an International Conference on Modelling and Design in Fluid-Flow Machinery in Gdańsk. He was invited to the International Organising Committee of the Third International Conference titled " Multiphase Flow 98" in Lyon and the Scientific Committee of a Workshop Varna'97 on *Tansport Phenomena in Two-Phase Flow.* He was a reviewer in international journals (International Multiphase Flow Magazine, International Heat Transfer Conference in Great Britain, International Conference on *Energy System and Ecology*) and others.

Zbigniew Bilicki
Institute of Fluid-Flow Machinery

Selection of most important papers by Prof. J. Mikielewicz

Monographs and textbooks

1. *Analysis of Possibilities of Implementation of "Liquid Fins" in a High-Temperature Variable-Pressure Recuperator*, Doctoral dissertation submitted to the Faculty of Machine Building, Technical University of Gdańsk, 1968, also

Bulletin the IFFM PASci, 44/716/1972.

2. *Selected Problems of Steam Generation in a Two-Component Cycle*, Habilitational dissertation (DSc) submitted to the Faculty of Machine Building, Technical University of Gdańsk, 1968, also Bulletin the IFFM PASci, 34/720/1972.

3. *Modelling of Thermal-Hydraulic Processes*, Fluid-Flow Machinery Series, Vol. 17, 1995, Ossolineum, Wrocław.

4. Trela M. Mikielewicz J.: *Motion and Heat Transfer of Thin Liquid Layers*, Fluid-Flow Machinery Series, Vol. 23, 1998, Ossolineum, Wrocław.

5. Mikielewicz J., Cieśliński J.: *Non-Conventional Apparatus and Systems of Energy Conversion*, Fluid-Flow Machinery Series, Vol. 24, 1998, Ossolineum, Wrocław.

6. *The Measurement, Instrumentation and Sensors Handbook – Temperature Indicators*, with J. Stąsiek and T. Madaj, (Chapter 32.10), Editor JG Webster, CRS Press IEE Press, 136-151, 1999.

Textbooks and printed series of course lectures

1. *Outline of heat and mass transfer*, with P. Kubski, College of Engineering, Koszalin 1979.

2. *Principles of thermodynamics*, IFFM PASci Scientific Notes, 182/1098/1984.

3. *Selected problems of thermo-mechanics*, part I, with A. Rasmus. College of Engineering, Koszalin, 1988.

4. *Theoretical foundations of energy conservation*, Proceedings of seminar *Energy conservation in a company*, Departmental Centre for Development of Ministry of Metallurgy and Machine Industry Staff, Gdańsk 1968.

5. *Foundations of Thermodynamics with Theory of Similarity and Principles of Modelling*, course notes for "Energoprojekt", Gdańsk 1987.

6. *Selected Problems of Ecological Energy Management*, with J. Cieśliński, printed series of course lectures, IFFM PASci, Gdańsk.

7. *Heat Transfer*, with B. Grochal, S. Polesek-Karczewska, S. Gumkowski, D. Mikielewicz, printed series of course lectures, IFFM PASci, Gdańsk, No. 162/97.

8. *Outline of Thermodynamics*, with H. Bieliński, D. Mikielewicz, printed series of course lectures, IFFM PASci, Gdańsk, No. 163/97.

9. *Non-Conventional Sources of Energy*, with J. Cieśliński, printed series of course lectures for Mechanical Engineering Department of TUG, 1996.

Original published research works

1. *Liquid fin – a new device for heat transfer equipment*, with J. Madejski, Int. Journal Heat and Mass Transfer, Vol. 14, 357-363, 1971.
2. *Minimum thickness of a liquid film flowing vertically down a solid surface*, with J. R. Moszyński, Int. J. Heat Mass Transfer, Vol. 19, 771-776, 1976.
3. *Breakdown of shear driven liquid film*, with J. R. Moszyński, Transactions of the IFFM, 66(1975).
4. *A method for correlating the characteristics of centrifugal pumps in two-phase flow*, with D. G. Wilson et al., Transaction of the ASME, J. of Fluid Eng., Vol. 100, 4(1978).
5. *The influence of surface roughness and the presence of gaseous medium on the wetability of metals*, with St. Szulc-Semiczek, 7th Symposium on *Materials Properties National Bureau of Standards*, Washington, 1977.
6. *Experimental study of evaporation and breakdown of thin liquid films driven by shear stresses*, with E. Ihnatowicz and St. Gumkowski, ASME Winter Annual Meeting, Dec. 1977, Atlanta USA, Paper 77-WA/HT-7, also in Transactions of the ASME J. of Heat Transfer, Vol. 101, 4(1979).
7. *Experimental investigation of contact angles of rivulets flowing down a vertical solid surface*, with St. Semiczek-Szulc, Int. J. Heat Mass Transfer, Vol. 21, 1978.
8. *Breakdown and evaporation of thin shear driven liquid films*, with J. R. Moszyński, Int. Seminar *Nuclear Reactor Safety Heat Transfer*, Dubrovnik 1980, also in a book edited by S. G. Bankoff, N. H. Afgan *Heat Transfer in Nuclear Reactor Safety*, McGraw-Hill Comp., 1982.
9. *Heat transfer in a channel at supercritical pressure*, with M. Adelt, Int. J. of Heat and Mass Transfer, Vol. 24, 10(1981), 1667-1674.
10. *A simplified model of flow boiling crisis*, with B. Sedler, Int. J. Heat Mass Transfer, Vol. 24, 1981, 431-438.
11. *Singular points in the solutions of two-phase flow equations*, with Z. Bilicki, ZAMM, Band 66, Heft. 4, 1986.
12. *Analysis of an annular-mist flow in a T-junction*, with E. Śliwicki, Int. J. Multiphase Flow, Vol. 14, 3(1988).
13. *Two-phase downflow in a vertical pipe and the phenomenon of choking*, with Z. Bilicki and J. Kestin, Int. J. Heat Mass Transfer, Vol. 30, 7(1987).
14. *The influence of oscillations on natural convection in ship tanks*, with S. Doerffer, Int. J. Heat and Fluid Flow, Vol. 7, 1(1986).
15. *A general correlation for saturated freon flow boiling in a horizontal tube*, with J. Iwicki and D. Mikielewicz, Proceedings of Baltic Heat Transfer Conference, Göteborg, Sweden, Aug. 1991, also in Recent Advances in Heat Transfer, ed. B. Sunden, A. Zukauskas, Elsevier Science, 1992.

16. *Natural convection in a single-phase loop*, with H. Bieliński, Proceedings of Baltic Heat Transfer Conference, Göteborg, Sweden, Aug. 1991, also in Recent Advances in Heat Transfer, ed. B. Sunden, A. Zukauskas, Elsevier Science, 1992.
17. *Simple theoretical approach to direct contact condensation on sub-cooled liquid film*, with A. M. Ragab, Int. J. of Heat and Mass Transfer, Vol. 38, 3(1995), 557-562.
18. *Direct vapour condensation on turbulent sub-cooled liquid film*, with Z. Droyński, Proceedings of a Conference on *Experimental and Predictive Methods for Energy Applications*, London 1994.
19. *An analysis of rivulet formation during flow of an air/water mist across a heated cylinder*, with M. Trela, Int. J. Heat Mass Transfer, Vol. 35, 10(1992), 2429-2434.
20. *Natural convection of thermal diode*, with H. Bieliński, Archives of Thermodynamics, Vol. 16, 3-4, 1995.
21. *Impingement of a liquid jet on an inclined plate*, Transactions of the IFFM, 100(1996).
22. *Modelling of wavy liquid film flow*, with D. Mikielewicz, Archives of Thermodynamics, Vol. 17, 1-2, 1997, 81-108.
23. *Heat transfer of two-phase spray impinging on a hot surface*, with D. Mikielewicz, Archives of Thermodynamics, Vol. 18, 3-4, 1997, 61-80.
24. *Impingement of two-phase gas-liquid jet*, Transactions of the IFFM, 102(1997), 79-88.
25. *Analytical model of heat transfer in films on rotating discs*, with D. Mikielewicz, Archives of Thermodynamics, Vol. 20, 3-4, 1999.