

A note about the life and scientific achievements of Zbigniew Kowalski (1924–1992)¹

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Abstract

The present paper contains biography of Zbigniew Kowalski (1924–1992). Information about his major scientific achievements in the field of ordinary and partial differential equations is given. A complete bibliography of Zbigniew Kowalski is also provided.

Keywords: biography of Zbigniew Kowalski, bibliography of Zbigniew Kowalski, history of mathematics, ordinary and partial differential equations, differential methods

¹ The text of the article is an extended version of the lecture given by the author during the XXXIII Conference on the History of Mathematics, Będlewo, 27-30 May 2019.

1. School times, studies and work at the Jagiellonian University

Zbigniew Kowalski was born on August 3, 1924 in Krakow in the family of Stanisław and Helena. His father was an official of the Polish Post Office (Archive of the Jagiellonian University in Krakow, Zbigniew Kowalski). Until the outbreak of World War II, he completed a six-year primary school and three years of the Gymnasium of H. Sienkiewicz in Częstochowa. During the war, he was in Niedźwiedź near Mszana Dolna. At that time, he was working on a farm. After the war, he returned to Kraków and graduated from junior high school and high school of Kościuszko, obtaining his high school diploma in 1946 (Węglowska, 2003: 110-111). In the same year, he began studying astronomy at the Jagiellonian University. However, in the third year of astronomy, he moved to mathematics, and in 1948 he started working as a junior assistant at the Department of Mathematical Analysis of the Jagiellonian University (Duda, 2012: 222). He obtained his master's degree in mathematics at the Jagiellonian University in 1952.



Zbigniew Kowalski
(August 3, 1924 – December 8, 1992)

From 1952 to 1956 he worked as an assistant, and in 1956–1961 as a senior assistant at the Department of Mathematical Analysis of the Jagiellonian University. Then, in 1961, he obtained his doctorate on the basis of the thesis: *The Certain Iterative Method of Solving Differential Equations*, (Archive of the Jagiellonian University in Krakow, Zbigniew Kowalski) the results of which are included in the publication: *An iterative method of solving differential equations*. Ann. Polon. Math. **12** (1962), 213–230. The supervisor of his doctoral thesis was Tadeusz Ważewski.

From 1961 to 1969, Kowalski worked as a research and teaching assistant. In 1969, he obtained his habilitation on the basis of the dissertation: *Difference methods for nonlinear equations with partial derivatives*, which relied of the results of works I–IV (Archive of the Jagiellonian University in Krakow, Zbigniew Kowalski), where:

- I. *A difference method for a non-linear parabolic differential equation without mixed derivatives*, Ann. Polonium. Math. **20** (1968) 167–177.
- II. *A difference method for a non-linear system of parabolic differential equations without mixed derivatives*, Bull. Acad. Polonium. Sci. Cheese. Sci. Math. Astronomer. Phys. **15** (1967) 683–689.

- III. *On the difference method for certain hyperbolic systems on non-linear partial differential equations of the first order*, Bull. Acad. Polonium. Sci. Cheese. Sci. Math. Astronomer. Phys. **16** (1968) 297–302.
- IV. *On the difference method for a non-linear system of parabolic differential equations without mixed derivatives*, Bull. Acad. Polonium. Sci. Cheese. Sci. Math. Astronomer. Phys. **16** (1968) 303–310.

During the next 20 years, until 1989, he worked as a full-time associate professor, and in 1989 he was awarded the title of professor (Archive of the Jagiellonian University in Krakow, Zbigniew Kowalski). Unfortunately, he died in a few years. Before his doctorate, Kowalski focused on the problems of approximate solving of ordinary differential equations, and then he started researching the methods of differential and integral equations. He has published 37 scientific papers. He promoted two doctors: Krystyna Szafraniec (1975) and Jacek Kaczmarczyk (1985). He was a member (and president) of the Polish Society of Amateur Astronomers and the Polish Mathematical Society. For his services, he was awarded the Gold Cross of Merit (1973), the Knight's cross of order of Polonia Restituta (1983) and the Medal of the National Education Commission (1987). He devoted his entire life to science until his untimely and unexpected death single. He died on December 8, 1992 in Krakow. He is buried in the Podgórze Cemetery in Kraków.

2. General characteristics of Zbigniew Kowalski's scientific achievements

Zbigniew Kowalski worked creatively in the field of ordinary and partial differential equations (Archive of the Jagiellonian University in Krakow, Zbigniew Kowalski). He achieved particularly significant scientific achievements in the application of difference methods to partial differential equations of the elliptical type and the parabolic type. The subject of works published by Zbigniew Kowalski concerns the following issues:

1. Stability of periodic solutions and generalized characteristic directions.
2. Certain variants of the method of successive approximations for ordinary differential equations and modification of Euler's broken method, as well as other approximation methods for differential equations that are solved with respect to the derivative of the unknown function.
3. Generalization of certain Filipov results in terms of certain measurability conditions for orientation fields.
4. Methods of consecutive approximations in the context of the example of divergence of the sequence of consecutive approximations despite the high regularity of the right side of the differential equation, if only for a given arbitrarily small interval the appropriate first term of the approximation is chosen.
5. Differential methods in the context of partial differential equations.
6. Difference approximation for equations and systems of partial differential equations of the parabolic type. (On the basis of five works on this subject, Z. Kowalski obtained his habilitation).
7. Difference methods in the context of systems of partial differential equations of the second order of the parabolic type weakly related, in which there are mixed partial derivatives.
8. Elliptical type differential inequalities and their applications in the difference method for elliptical type partial differential equations, in particular in the proof of convergence of the differential approximation for the Dirichlet problem for the nonlinear partial differential equation considered in the n -dimensional cube.
9. Differential inequalities of the elliptical type in the context of systems of partial differential equations of the elliptical type. In this subject,

- Z. Kowalski made a very significant contribution to the development of the theory of difference methods for elliptical differential equations.
10. Difference methods in the context of the thermal conductivity (diffusion) equation.
 11. Difference methods as applied to partial differential equations of order greater than two. Kowalski considered here the equations solved with respect to the temporal derivative, assuming that the equations do not contain derivatives with respect to time of the order greater than one, nor do they contain mixed derivatives with respect to spatial variables. (The transition from second order partial differential equations to higher order partial differential equations is not automatic and requires many nontrivial mnemonic steps to overcome the significant difficulties that arise and is a major contribution to the development of the theory of partial differential equations).
 12. Difference methods for partial differential equations of the second order containing partial derivatives mixed due to spatial variables. (This is another important result of Z. Kowalski in the development of the theory of difference methods as applied to partial differential equations).

3. Full bibliography of Zbigniew Kowalski's scientific works

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Remark. In the future, a more detailed study of Zbigniew Kowalski's scientific results will be published in a comprehensive study in Polish.

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