RUSSIAN-GERMAN COOPERATION IN THE FIELD OF COMPUTATIONAL FLUID DYNAMICS — A NEARLY 40 YEARS OLD FRIENDSHIP

K. G. Roesner
Technische Universität Darmstadt
Institut für Strömungslehre und Aerodynamik, Germany
e-mail: kgroesner@t-online.de
http://www.kgroesner.de

1. The beginning of the story

It started in September in 1967 during a sightseeing tour in a German BMW-car in Warsaw. The driver: Professor Wladislaw Fiszdon of the Polish Academy of Sciences. The passengers on this trip through Warsaw: Prof. Nicolai Nicolaevich Yanenko, my wife and me. What was the reason of that encounter in the time of the so-called Cold War?

My wife and me had arrived at Warsaw central station the same morning after a terribly long journey by train from Göttingen via East Germany and Berlin, feeling sleepy and hungry, waiting in the entrance hall of the ORBIS-Hotel of the Polish travel agency in Krucza street for the transportation by bus to a place far North of Warsaw, to Tarda, in the beautiful landscape of Masury. We were invited by the Polish Academy of Sciences to take part in the VIII Symposium on Advanced Problems and Methods in Fluid Mechanics, hosted by Professor W. Fiszdon. Feeling a bit lonely among a lot of other tourists in the hotel we looked for something to eat, but without success.

In this moment Professor Fiszdon arrived, took his colleague, Professor Nicolai Nicolaevich Yanenko, and us to the dining room of the hotel and invited us for a wonderful breakfast. We felt after such a warm welcome ceremony very much recreated, and being invited by Prof. Fiszdon, together with Professor Yanenko, the sightseeing tour mentioned above started.

At the end of the day all the foreign participants of the scientific conference with their Polish colleagues arrived after a long bus trip through North of Poland at Tarda, the village where the conference should take place. During that meeting especially the numerical methods for the simulation of gasdynamical flows were discussed in detail, and as I was at that time deeply involved in the field of research of computational fluid dynamics, I could realize that the Russian applied mathematicians had already developed excellent numerical techniques based on the method of characteristics and of finite differences. The presentations of V.V. Rusanov and N.N. Yanenko made me feeling that most of the fundamental results of the Russian schools of Applied Mathematics in Moscow and Novosibirsk were not known in West Europe. The Iron Curtain was at that time a nearly perfect barrier for any exchange of experience in any field

of sciences. And in addition to this political barrier the barrier of language made it at that time nearly impossible to get knowledge of the scientific results of our colleagues in Eastern countries like the USSR of that time. All their results were published in Russian Journals, and only some of them were available in Western countries.

Discussing with N.N. Yanenko the subject of my own Ph. D. thesis which was devoted to the three-dimensional time-dependent calculation of gasdynamical flows, he promised to send me his new Russian book on the so-called method of fractional steps. He suggested that I should study the method and translate his book into German language.

2. The outcome of a fruitful conference talk

It is very seldom that the time of an essential event in the life of a human being can be dated back by the exact date when it took place. For me, the dedication in Yanenko's book, published in 1967, which he had sent to me, marks a milestone in my scientific career. In Fig. 1 the cover of his famous book is shown with the dedication, dated 20^{th} October 1967.

Having acquired some knowledge in the Russian language, which I had studied during my stay at the University of Göttingen, I followed Nicolai Nicolaevich's advise and found it worthwhile to translate his monography into German language. At the end of a time-consuming translation I delivered the manuscript ready to print to the Springer-Verlag together with the handwritten filled-in mathematical formulas. The monography was printed as volume No. 91 of the Lecture Notes in Mathematics of the Springer-Verlag in 1969.

While translating this book, I often contacted Nicolai Nicolaevich by mail to get help for the right choice of special mathematical items which he used in Russian language and for which a direct counterpart in German language was not clear. He gave me many grammatical advises to find the correct translation. His knowledge of the German language was excellent, and especially for the correct translation of unusual mathematical terms in Russian language he answered in

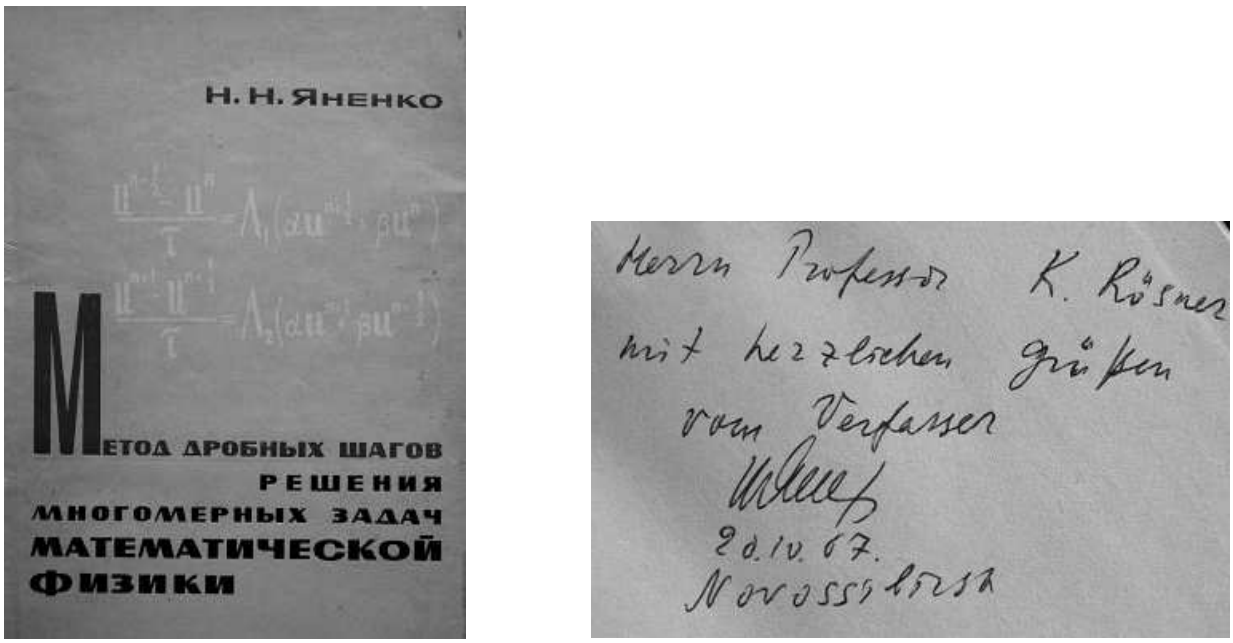
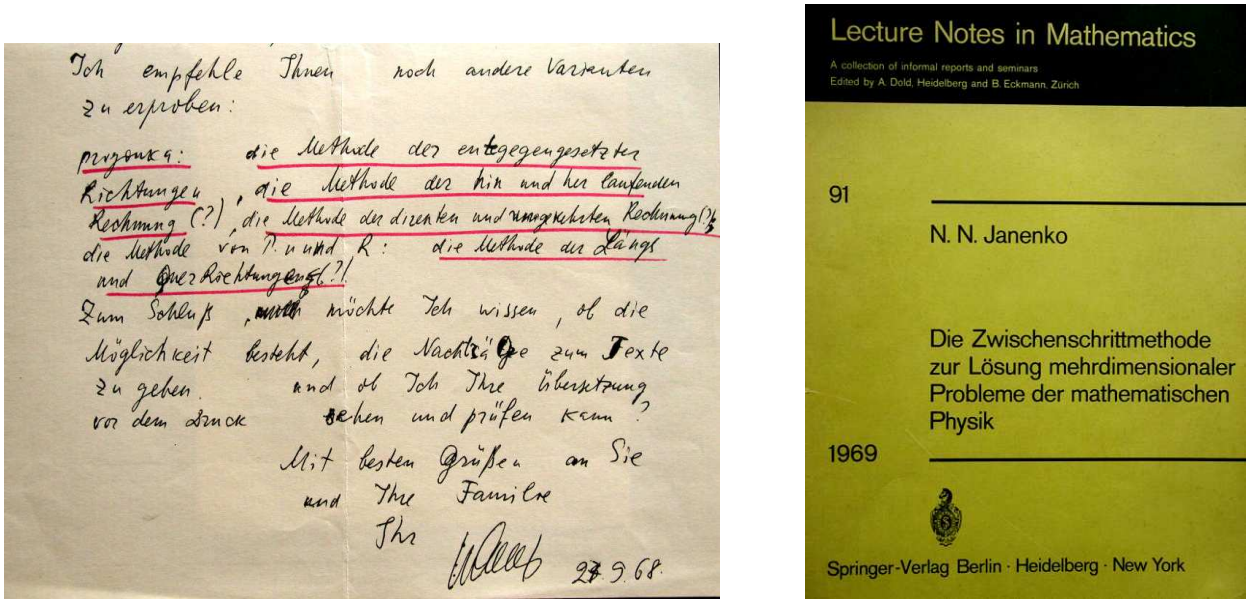


Fig. 1. Cover of the monography and dedication signed by N.N. Yanenko.

lengthy letters to my questions. Fig. 2, *a* shows the end of one of his handwritten letters, four pages long, answering my questions about the Russian term "прогонка".

When we met again two years after our first encounter in Warsaw on the occasion of the IX Symposium on Advanced Problems and Methods in Fluid Mechanics, which took place in Kazimierz, I was happy to present Nicolai Nicolaevich the brandnew issue of his monography (fig. 2, *b*).

During this Symposium a paper was presented by N.N. Yanenko with three other co-authors: N.N. Anuchina, V.E. Petrenko, and Y.I. Shokin entitled by "On numerical methods of solving



a *b*

Fig. 2. Handwritten letter discussing the term "прогонка" (*a*); cover of N.N. Yanenko's translated monography (*b*).

Fig. 3. N.N. Yanenko and V.V. Rusanov after a hard working day during the Symposium.

gas dynamical problems with large deformations". This was the first time, when the name of Yanenko's best co-worker, Yurii Ivanovich Shokin, attracted my interest.

These biennual Symposia in Poland were well-known all over the world because of their wonderful atmosphere where scientists could meet personally and discuss their problems in direct contact with each other. The following fig. 3 reflects the relaxed atmosphere in Kazimierz, a historical place near the Wisla river.

3. The transitive character of friendship from one generation to the next

In 1973, during my time at the Institute of Applied Mathematics of the Albert-Ludwigs-Universität Freiburg I invited for a longer stay Yu.I. Shokin. This stay was financed by the Deutsche Forschungsgemeinschaft with the aim to strengthen the earlier started cooperation between the Computing Center of Akademgorodok and Freiburg University. So, Yurii Ivanovich became a real friend of our family and he enjoyed using the IBM UNIVAC 1108 computer of the University, a comfortable and fast machine at that time. His research project was devoted to numerical methods of gasdynamical flows especially to the analysis of the stability character of finite difference methods. In his later scientific work, Yu.I. Shokin developed the "Method of the First Differential Approximation" which attracted my interest from the point of view of using computer algebra for the analysis of the difference schemes. I was convinced by the way how to get insight into the character of any difference scheme by formalized method of the so-called first differential approximation.

In the following years it was possible to invite Russian mathematicians for a visit in Germany. Those stays were financed and supported by the Deutsche Forschungsgemeinschaft, and vice versa I myself got the chance to stay for longer periods in Russia together with N.N. Yanenko and Yu.I. Shokin in Akademgorodok. On the occasion of my last visit in 1979, Yurii Ivanovich showed me his book entitled: МЕТОД ДИФФЕРЕНЦИАЛЬНОГО ПРИБЛИЖЕНИЯ and wrote a personal dedication into the monography before I left home, shown in fig. 4.

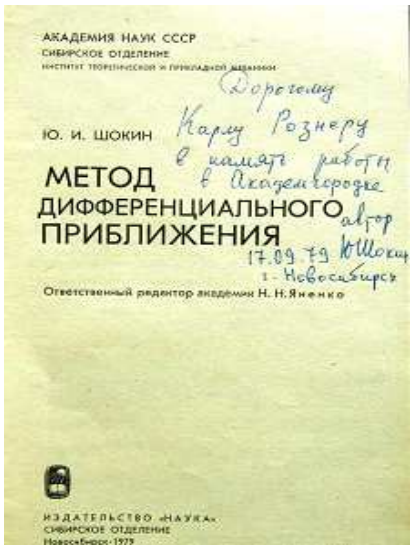


Fig. 4. Yu.I. Shokin's dedication in his monography on the Method of Differential Approximation.

Being back in Germany, I studied the content of this book, found out that the mathematical theory behind it, was very useful, and contacted again the Springer-Verlag suggesting to translate this Russian monography into English language to guarantee a wider readership for this new idea explained in this book. While translating the monography, further new results had to be inserted, and it took me a long time of detailed work, patiently rewriting and enlarging the manuscript, to finish with this work in 1983, one year before N.N. Yanenko passed away. So, he could see that our first encounter in 1967 was bearing substantial fruit in the future. When Nicolai Nicolaevich died in 1984, it was an unreplaceable loss for the international scientific community. But his idea of spreading out scientific results despite political borders between countries stayed alive.

The following years were marked by fundamental changes in the relationship among Western and Eastern countries. The scientific community could use the Internet as a fruitful tool to communicate around the world and exchange ideas.

Using this tool, I started again at the end of the last century a strong cooperation with the mathematicians of Akademgorodok, especially the brillant students of the younger generation. Several years passed, and at the end of this cooperative work in 2001 a remarkable Ph.D. thesis was presented by Nina Yurievna Shokina at the Technische Universität Darmstadt to get the academic degree of Dr.-Ing. from the Faculty of Mechanical Engineering. She was my best Ph.D. student in Applied Mathematics during my time as professor at the TUD.

Due to the transitive character of friendship, which began with the famous teacher N.N. Yanenko and included later his former student Yu.I. Shokin, a link was possible to the third generation of Russian mathematicians of today.

Is there any better example of immortality of N.N. Yanenko's great idea of friendship among scientists?

Received for publication Mart 10, 2006