Applications of Mathematics

Eduard Feireisl; Josef Málek; Antonín Novotný; Mirko Rokyta; Michael Růžička
Foreword [Proceedings of the Eighth International School on Mathematical Theory in Fluid Mechanics in memory of Professor Jindřich Nečas]

Applications of Mathematics, Vol. 49 (2004), No. 6, 499--500

Persistent URL: http://dml.cz/dmlcz/134582

49 (2004) APPLICATIONS OF MATHEMATICS No. 6, 499–500

FOREWORD

This special issue is dedicated to the Memory of Professor Jindřich Nečas (December 14, 1929 - December 5, 2002)

In June 2003, the Eighth International School on *Mathematical Theory in Fluid Mechanics* was held (following tradition) at the small village of Paseky in the northern part of the Czech Republic. The main portion of the program consisted of the series of lectures delivered by Rinaldo Colombo (Brescia, Italy), Benoît Perthame (Paris, France), Michael Růžička (Freiburg, Germany) and Misha Vishik (Austin, USA). This issue contains the articles based on the lecture notes of the speakers.

During this school, *Rinaldo Colombo* presented results on a set of techniques, called Wave Front Tracking, which were introduced to construct approximate solutions to systems of hyperbolic conservation laws. His article *Wave Front Tracking in systems of conservation laws* provides several examples (ideal gas dynamics, liquid-vapor phase transition, the combustion problem, traffic flow) proving remarkable utility of the method.

In his lecture course, *Benoît Perthame* spoke on mathematical properties of various systems of PDEs proposed to model chemotaxis. For this purpose, the classical Patlak/Keller-Segel model, some special continuum and kinetic models of hydrodynamics, and a degenerate parabolic system proposed to model the formation of capillarity blood vessels were covered and discussed. This material forms the content of the second article entitled *PDE models for chemotactic movements: parabolic, hyperbolic and kinetic.*

The last paper of this issue *Modeling, mathematical and numerical analysis for electrorheological fluids*, written by *Michael Růžička*, describes an approach to continuum modeling of electrorheological fluids. These are suspensions consisting of solid particles and a carrier oil. Once a simplified model is settled, its mathematical properties are studied. Here, the author focuses on proving local-in-time existence of strong solutions for large data, which can be then applied to obtain error estimates for a fully-implicit time-discretization.

Finally, *Misha Vishik* concentrated in his Paseky course on questions of stability and instability of flows of the Euler and Navier-Stokes fluid. His contribution should appear in a later issue.

The program of the school also included short communications, preprints, reprints and book exhibitions and hours and hours of discussions of all the participants. We thank all of them for attending the school and for their contributions. Those who are interested in more details about this, former as well as future schools can visit the school web-page

`www.karlin.mff.cuni.cz/paseky-fluid/`

The Paseky school No. 8 was the first one that took place after Professor Jindřich Nečas passed away.

Jindřich Nečas was one of the co-founders of the school since the first dreams and ideas to start doing something like this occurred. We only later on realized that he himself

organized similar type of schools in the sixties, when he was our age; the schools were focused on modern methods in the theory of partial differential equations.

During the Paseky schools, Jindřich Nečas frequently said that he was the "disorganizer" rather than an organizer, meaning that in his opinion he always initiated chaos in time schedules etc. Of course, just the opposite was true. He was the key person, attracting people from abroad to attend the school again and again (both young and well-established experts), relaxing the atmosphere with jokes, interrupting the speakers with questions and comments during their lectures, contributing significantly to discussions after the lectures and short communications, introducing young people to the main lecturers.

This role of Jindřich Nečas cannot be overemphasized. He was always interested in all that young people are working on, always expressing his opinion about the problems, encouraging them in their effort. For many Czech and even foreign students, the Paseky school was their first international meeting and we know that thanks to Jindřich Nečas their interest in research was greatly stimulated and encouraged.

The schools supervised by Jindřich Nečas had a very high scientific level. The list of main speakers that presented the series (usually of five lectures) includes experts such as Claude Bardos, Marco Cannone, Constantine Dafermos, Jens Frehse, Giovanni Paolo Galdi, Vivette Girault, Michael Griebel, John Heywood, Alexandre Kazhikov, Dietmar Kröner, William G. Litvinov, Nader Masmoudi, Akitaka Matsumura, Serguei Nazarov, Mariarosaria Padula, K. R. Rajagopal, Martin Rumpf, Gregory Seregin, Vsevolod A. Solonnikov, Vladimír Šverák, Lutz Tobiska, Athanasios E. Tzavaras, Wolf von Wahl. The lecture notes were carefully edited and published first in the Pitman Research Notes in Mathematics Series, later on by Springer and finally as special issues of Application of Mathematics. The important feature of the school consisted in the fact that people stayed together after the official program was over, having thus the opportunity to engage with each other in such a way that many friendships and long lasting collaborations leading to numerous publications resulted as the side output from these schools.

The meeting point for Paseky evenings is the bar in the cellar. It was amazing that Jindřich Nečas was frequently accessible there (drinking just the one small glass of beer his daughter permitted him) to discuss any topic including mathematical, historical, political and social themes. He was also an unforgettable singer and initiator of several music sessions with Czech, Moravian, Slovak and international songs.

In the above lines, we wanted to address the irretrievable role Professor Nečas played at the meetings on analysis in fluid models at Paseky[1] and, obviously, we miss him. Let us hope that his many followers can fill the gap that remains after his departure.

September 2004

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