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Editorial

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EDITORIAL

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This volume is composed of the papers presented at the Multiple Scale Systems and Systems with Hysteresis conference in Ostravice, Czech Republic in May 29–June 3, 2022. Postponed due to the pandemic, the conference was originally planned for 2020 marking the 100th anniversary of Mark Aleksandrovich Krasnosel'skii. The scientific school of Nonlinear Functional Analysis created and led by Mark Krasnosel'skii from 1950s reared several generations of excellent mathematicians—The Mathematics Genealogy Project alone lists 52 PhD students and 663 scientific descendants of Mark Aleksandrovich.

The conference in Ostravice was the 10th workshop of the **Mu**lti-**r**ate **P**rocesses and **Hys**teresis (MURPHYS) conference series conceived at the beginning of the 2000s by Alexei Pokrovskii, a former student of Mark Krasnosel'skii.

Apparently having very different personalities, Mark and Alexei were both extraordinary scientists and charismatic educators. Very kind and caring persons, absolutely devoted to mathematics, they inspired students and fellow mathematicians, influenced collaborators from other disciplines, generously shared ideas and created a very stimulating and friendly atmosphere to work in for their students and colleagues.

"Systems with Hysteresis", the impactful pioneering mathematical monograph on the subject of hysteresis by M. Krasnosel'skii and A. Pokrovskii, was first published in 1983 in Russian followed by its translation into English in 1989. The book laid the foundation for the mathematical theory of hysteresis based on the concept of a hysteresis operator. It addressed a wide range of topics including the interpretation of phenomenological models of hysteresis as nonsmooth operators acting in functional spaces; regularity of hysteresis operators; identification theorems; properties of individual trajectories of stochastic differential equations; links to the theory of sweeping processes, differential inclusions and the theory of discontinuous operators; superposition, composition and inversion of hysteresis operators; and properties of solutions

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to ordinary differential equations coupled with hysteresis nonlinearities. As such, the monograph for the first time opened the door to the application of geometrical and topological methods of functional analysis to modeling and analysis of systems with hysteresis.

"Systems with Hysteresis" inspired further monographs oriented towards the needs of engineering applications. Classical phenomenological models of hysteresis describe complex history-dependent constitutive relations of materials and media associated with plasticity, dry friction, magnetic memory, sorption hysteresis etc. In dynamic models of media, these constitutive operator relations are combined with differential equations of motion, field equations and balance equations. Motivated by these applications, the theory developed in the 1990s in the monographs by I. Mayergoyz, A. Visintin, M. Brokate and J. Sprekels, P. Krejčí addressed energy balance, thermodynamics of hysteresis modeling, partial differential equations with hysteresis operators and control problems. Variational inequalities appeared as an effective tool for analysis of hysteresis operators and PDEs. A series of scientific meetings organized by Augusto Visintin in Trento, Italy at the same time provided a forum for exchanging ideas among the researchers in the mathematics of hysteresis phenomena.

The MURPHYS conference series originated from Alexei Pokrovskii's idea to explore the links between the theory of multi-rate systems and the theory of hysteresis operators. The pilot workshop organized by Alexei together with M. Mortell, R. O'Malley Jr. and V. Sobolev in 2001 grew to a series of biennial workshops. The University College Cork in Ireland provided a home for these workshops in 2002, 2004, 2006 and 2008. The following conferences and a series of graduate summer schools associated with the MURPHYS conference series were organized in Pécs, Hungary (2010), Lutherstadt Wittenberg (2011), Suceava, Romania (2012), Berlin, Germany (2014), Levico Terme, Italy (2015), Barcelona, Spain (2016), (2018) and Turin, Italy (2017), (2019) by A. Iványi, M. Dimian, O. Klein, D. Davino, M. Eleuteri, C. Visone, A. Korobeinikov, P. Gurevich and V. Recupero.

The multidisciplinary character of the MURPHYS conferences series became the hallmark of the meetings, where half of the talks were contributed by mathematicians and the other half by engineers, hydrologists, physicists, biologists and economists sharing interests in hysteresis and multi-scale phenomena. This unique stimulating environment led to many memorable exciting discussions, often mediated by Alexei Pokrovskii and by Pavel Krejčí, who supported the series from day one and contributed to all the conferences and summer schools. Their energetic, enthusiastic and knowledgeable contributions were instrumental for the successful communication of researchers with diverse backgrounds, which resulted in multiple interesting collaborations.

The Multiple Scale Systems and Systems with Hysteresis conference organized by J. Kopfová, P. Nábělková and P. Krejčí against the beautiful scenery of Moravian-Silesian Beskids, continued the tradition of multidisciplinary MURPHYS meetings, and the present focused volume of the conference papers will hopefully be of interest to the readers of Applications of Mathematics.

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