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Editorial

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EDITORIAL

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This special issue of the journal is devoted to stochastic geometry and stereology, related mathematical disciplines joining ideas from probability theory, mathematical statistics and geometry and having numerous applications in materials research, biomedicine and other fields. The issue is published in the year of anniversaries of two scientists who were founders of stereology in the Czech Republic, namely Vratislav Horálek and Ivan Saxl. In 1956 V. Horálek became interested in the problem of obtaining information concerning 3D structure of materials from their planar sections. Later on, in 1961, the name stereology was coined for this branch of applied mathematics and the International Society for Stereology was founded. The interest in these areas was so high that in 1976 the Stereological Section of the Czech Cybernetical Society was established by V. Horálek, I. Saxl, and their colleagues. V. Horálek was elected its first chairman and kept this position till 1991. The second chairman was I. Saxl, after political changes it was possible to organize the 6th European Congress for Stereology in Prague, 1993. Both V. Horálek and I. Saxl paid a great attention to the promotion of stereological approaches in industrial research, to education of young specialists as well as to the international activity of the section.

Ing. Vratislav Horálek, DrSc., was born on August 16, 1926 in Roudnice upon Elbe. He graduated in Engineering from the Czech Technical University, Faculty of Special Studies, in 1950 and received Ph.D. in 1961 at the Faculty of Mathematics and Physics of Charles University in Prague and DrSc. in 1969 at the Institute of Physical Metallurgy of the Czechoslovak Academy of Sciences in Brno. From 1952 till his retirement in 1991, V. Horálek was employed in the Division of Applied Mathematics of the National Research Institute for Machine Design in Prague, first as senior research worker, later as the Head of the Research Group on Stochastic Analysis, and finally he was appointed the Head of the Division of Applied Mathematical Statistics.

He has been concerned with problems in the theory of probability, mathematical statistics, stochastic geometry, image analysis and stereology, as well as in their

applications in solving technical problems from metallurgy, metallography, drying technologies, metrology, methodology of statistical process control and all activities in ISO/TC69 for applied statistics. The way to generalization of the homogeneous Johnson-Mehl tessellation model to the non-homogeneous one and the analysis of the non-homogeneous birth-immigration-death processes deriving corresponding necessary conditions belong to his most important mathematical achievements. He published 269 scientific and professional papers, some of them in top journals (e.g. Adv. Appl. Probability, Journal of Microscopy, Metrika, Materials Characterization). Among them, 43 were presented on international conferences or seminars and 120 as research reports.

It should be stressed that the main working area of V. Horálek was his assignment of introducing statistical methods in standardization of measurements in materials production and technology. From 1954, he cooperated with the Czech Office for Standards, Metrology and Testing (COSMT) in preparing Czech Standards, and received ISO Standards (prepared in ISO/TC69 Applied Statistics) as ČSN ISO Standards. After establishing TC4: Applied Statistics in 1969, he was elected in the position of Chairman of TC4 at COSMT. During these 46 years, he prepared in total 74 ČSN and ČSN ISO Standards on applied statistics.

RNDr. Ivan Saxl, DrSc., was born in 1936 in Pardubice. In 1959, he finished his studies of physics at Charles University in Prague, Faculty of Mathematics and Physics, obtained his Ph.D. in 1974 (thesis: Interaction of dislocations with twins) and became Doctor of Science in 1984 (Stereology of high temperature degrading processes). In 1959–1962 he was an assistant at the Department of Physics, Czech Technical University, Prague. Starting from 1962 his scientific career was connected to the Academy of Sciences of the Czech Republic (formerly Czechoslovak Academy of Sciences): 1962–1973 Nuclear Research Institute in Řež, 1973–1983 Institute of Physical Metallurgy, 1984–1990 Institute of Geophysics, 1990–2009 Institute of Mathematics.

Applications of mathematics in elastic theory and crystallography of dislocations in metals, high temperature deformation and fracture, stereology, integral and stochastic geometry, and history of mathematics were fields of his interest. The outstanding contribution by I. Saxl to the understanding of mechanisms of creep deformation and microstructural changes of polycrystalline, mostly model metals and alloys, can be traced back to his involvement in studies of creep, dating from the early seventies. Rapid development of instrumentation and quantitative methods, stimulated by ever growing demand for an objective description of the kinetics of processes taking place in space and time, led him to stochastic geometry. His scientific contribution to the development of spatial geometrical models and stereological methods was significant, he became an author of two and co-author of two other monographs in design-based stereology, point processes and applications of stereology in materials

science. He prepared more than a hundred scientific papers (some of them in prestigious journals) and many presentations on international conferences. He passed away in December 2009.

Both I. Saxl and V. Horálek were hard-working and devoted scientists endowed with an extraordinary ability of finding a common language between theory and practice. While being excellent listeners, they liked to discuss problems in a pleasant warmhearted way, however without compromising the scientific quality. Their direct followers in stereology were the author of this editorial (young collaborator of V. Horálek in the National Research Institute for Machine Design) and Jan Rataj (doctoral student supervized by I. Saxl), who are currently professors at Charles University, Faculty of Mathematics and Physics, and have been supervizing further doctoral students in stochastic geometry.

The present issue of Applications of Mathematics contains some papers written by them. In the paper by J. Kopecký and T. Mrkvička the pure and the new modified Bayesian methods are applied to the estimation of parameters of the Neymann-Scott point process. Their performance is compared to the fast, simulation-free methods via extensive simulation study. J. Dvořák and M. Prokešová consider a flexible class of space-time point process models, the inhomogeneous shot-noise Cox point processes. They study the asymptotic properties of the resulting parameter estimators and formulate a set of conditions sufficient for establishing consistency and asymptotic normality of the estimators under the increasing domain asymptotics. J. Večeřa investigates a special case of finite Gibbsian facet process with a discrete orientation distribution and with increasing intensity of the reference Poisson process. All asymptotic joint moments for interaction U-statistics are calculated and using the method of moments the central limit theorem is derived. The interaction processes of unions of planar objects of simple shapes are studied in the paper by K. Helisová and J. Staněk, where besides the existence theorem various properties are derived and simulations of the processes are presented.

Other papers are written by established foreign researchers, the one of R. Armanjan is devoted to integral geometry. He deals with the question whether there is a subclass of zonoids admitting a local equatorial characterization. In this article a sufficient condition is found for a centrally symmetric convex body to be a zonoid. L. Heinrich derives a representation formula for all cumulant density functions in terms of the non-negative definite kernel function defining an α-determinantal point process. He uses this mixing property to prove rates of normal convergence for shot-noise processes, and to sketch some applications to statistical second-order analysis of the process. D. Jeulin makes use of stochastic geometry to model point defects in materials with some degree of alignment. Theoretical results on the probability of fracture of convex specimens are derived in the framework of the weakest link

assumption. These results are used to compare geometrical effects on the sensitivity of materials to fracture. X. Gual-Arnau and L. M. Cruz-Orive discuss surface area estimation for 3D sets. Previous estimator for convex set was based on the invariator principle of local stereology. Using Morse theory, they obtain a simplified version of the estimator for nonconvex sets of smooth boundary.

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