REFERENCES

1. **Comments of the R.H. Baran** (Naval Surface Weapon Center, White Oak (U23), Silver Spring, Maryland 20903-5000 U.S.A.) cited from the preliminary version of conclusions to the paper 1):

"Dr.Kovanic's gnostical theory provides a non-parametric procedure for fitting distribution and density functions to small data samples whose underlying distribution functions are S-shaped[1] and whose underlying densities are not sharply peaked. The gnostical distribution (density) function is a consistent estimator in the degenerated case of the deterministic variable (5) and, accepting the strong suggestion of the computation just described; in the case of the logistic model (VI).
The gnostical theory is offered as a solution to the general location problem in which nothing is known *a priori* about either the scale or the shape of the underlying distribution. In construing it as a perspective on the problem of distribution, the originator's intent is not strictly adhered to. As noted by Weiss (1985), consistent parameters of location perform in a manner circumscribed by the Bahadur bound, which governs their rate of convergence in the limit of large sample size. The general location problem remains open; but the remarkably good performance of the gnostical location estimator with respect to others (documented by Dr. Kovanic in Section 6) might be attributable to a logistic quality in the cases considered, as well as, to the robustness of the estimator. The effort that would be required to evaluate the performance of the gnostical location estimator by Monte Carlo methods is beyond the scope of this commentary.
In offering a "gnostical" theory of data samples, Dr. Kovanic will cause some readers to recall the early history of the Christian religion. (The Gnostics sought truth outside the official Gospels andwere sternly rejected by the Church authorities.) Dr. Kovanic's exhortation to "Let the data speak for themselves,", his careful avoidance of such standard parlance as "random variables", and his repeated denials of "statistical assumptions" seem designed to put distance between the gnostical and statistical viewpoints. This correspondent, being an engineer with some specialization in random processes, must defer to others regarding the ultimate significance of the work in question. According to Neuts (1985), the present time marks the dawn of a science of measured uncertainty which subsumes mathematical statistics under its aegis. If one can believe in the relentless utilitarianism of natural science, which assimilates whatever it finds interesting and useful, the important elements of the gnostical theory must find their way into the mainstream."

[1] Kovanic's comment: Distributions of non-S-shape as well as distributions having the U-form of density and multimodal distributions can be also modeled by the gnostic algorithms.

2. SELECTED COMMENTS OF EXAMINERS OF THE DR. KOVANIC'S DrSc.-DISSERTATION

2.1 RNDr. Albert Perez, DrSc.[2]:

The submitted dissertation solves the pressing problem of the maximum utilization of small samples of uncertain data for the effective decision making using an original method. Mathematical statistics has not managed and can or could not manage this problem without extended, strong assumptions on the data model under non-asymptotic conditions. Other approaches are not reviewed because of their biased nature.

The goal of the dissertation is a mathematic modelling of natural relations in the quantitative recognition of reality based on simple assumptions, which can be practically justified and which result in algorithmic methods of the handling of small data samples highly disturbed by the uncertainty of an unknown nature. According to my point of view, this goal was accomplished, at least for a very broad data model (which can be characterized as „physical“ data) delimited by the axioms of individual data and of data composition. The success of this solution is documented not only theoretically, but also by the use of a broad spectrum of applications of „gnostic“ estimators which satisfy the requirements of robustness and sensitivity, according to the type of decision making process.

As shown in the dissertation, some gnostic estimators can be interpreted (under some additional statistical assumptions) as statistical M-estimators, or Parzen's estimators, with special kernels and proof of their favourable asymptotic features. However, this does not mean (as supposed by some statisticians), that gnostic estimates are actually special cases of statistical ones and as such covered by the statistical theory. This is definitely <u>not the case</u>, because statistical theory does not describe the behaviour of such estimates in the <u>non</u>-asymptotic region (i.e. for small data samples, to which our interest is focused). In contrast to this, gnostic theory derives some very interesting near boundary features of these estimates (for small samples inclusively); features which the statistical theory cannot begin to address. The unique and original introduction of the notion of the ideal gnostic cycle, along with other novel approaches opens completely unsuspected paths of development, even in statistics, which is largely deficient in addressing the problem of small samples. This deficiency cannot be recovered, while the statistical approaches will be inertly held.

The aforementioned conservatism of some Czechoslovak statisticians has reached such a level, that, sad to say, even pseudo-scientific arguments were utilised to silence the author of the gnostic theory. This effort did not succeed thanks to the author's tenaciousness and also due to the support of some objective colleagues.

[2] Head of the Department of Information Theory and member of the Academic Council of the Institute of Information Theory and Automatiton of the Czechoslovak Academy of Sciences.

The binary model of uncertain data, where the first component is the true (ideal) value and the second component, which characterizes the uncertainty disturbing the first component either additively or multiplicatively (while the latter model can be thought of as the exponential function of the former), is common in mathematical statistics, at least in its additive form. But no assumptions of probabilistic or statistical character are accepted by the author with respect to the second component. The author makes do with substantially more elemental algebraic assumptions, from which he derives important geometric pieces of knowledge: a vector attached to the data is turned in the Minkowskian plane by the uncertainty. This is an analogy to the Lorentz transformation of the event's coordinates caused by the relative velocity of the observer in relativistic mechanics. The so called quantification process is described in gnostic theory in this way. The estimation way naturally directed to the best estimate and based on the observed value of the measured quantity (quantification's result) is dual to the quantification. This estimation takes place in the Euclidean plane by back rotation of the vector along the Euclidean circle intersecting with the quantification (Minkowskian) circular path in the point representing the observed uncertain data value. Relatively general conditions are shown of the uniqueness of the model. Isomorphism of these geometric models with algebraic structures of so called pair numbers is shown in detail. The quantification model is thus uniquely bound with the algebra of dual numbers, estimation model with the algebra of complex numbers. Uncertainty plays the role of a parameter of rotation in both of these algebras. The method of using the pair numbers then enables the fundamental notion of the ideal gnostic cycle to be defined mathematically.

The theory then introduces the notions of quantifying and estimating <u>weights</u> and <u>irrelevances</u> (generalized data errors), in a natural manner, as components of the pair numbers-operators rotating the data vector by the angle necessary to identify it with its mirror image. Relations of these data characteristics to "entropy" and "information" is shown by means of a "Gedanken Experiment" of the thermodynamic type. These relations result from a remarkable balance made in terms of field theory by the analysis of the sources and outlets of the "entropy" field. The change of information obtained in this way then has the form of Shannon's binary probabilistic information, whereas the corresponding gnostic function possesses features of the distribution function of the ideal data value with a given observed value.

The importance of the introduced gnostic characteristics is confirmed by the analysis of the limit features of the branches of the gnostic cycle: the entropy increase is maximized along the quantification path (with respect to paths deviating from the ideal gnostic cycle) while the loss of information is minimized and the drop in entropy is maximized along the estimation path of the gnostic cycle. These estimation entropy drops and information increases only partially compensate the quantification changes in a general case.[3]

The Gnostic data composition axiom for the weights and irrelevances of individual data (and for probabilities of the mentioned type) is motivated by the "inter-science" isomorphism of gnostic theory with relativistic mechanics. Gnostic composition law is thus a formal image of the Energy

[3] Author's note: this is not an imperfection of the theory but its achievement: the proved non-reversibility of the gnostic cycle is dual to the non-reversibility of the real thermodynamic cycle stated by the Second Law of Thermodynamics.

and Momentum Conservation Law valid for relativistic uncharged particles. This composition axiom enables a number of estimators of gnostic characteristics of (homogeneous) data samples to be introduced. A fundamental role is played in these characteristics by the so called scale parameter, which is also an object of consideration in this dissertation. The optimization of the scale parameter to ensure the minimum of the maximum distance between the estimated distribution function and empirical distribution function is interesting in this connection.

The robustness of the gnostic estimates is demonstrated, resulting from the robustness of the gnostic data weights and irrelevances, on which these estimates are based. The way in which these characteristics are chosen is not a direct result of the theory as they could have been chosen in a different way. In the theory their choice has been justified directly, as well as, through the favourable results of this choice with additional support from their success in applications. Increasing the knowledge of this aspect can be an interesting direction for further development of the gnostic theory.

The review was focused in the first place on the conceptual kernel of the dissertation when it was reviewed. From the minor insufficiencies one, in particular, deserves to be mentioned: the additivity of two random variables cannot be taken as additivity of their distributions, as done by author in page 128.[4]

It can be concluded that the underlying work represents a remarkable theoretic contribution with far reaching applications in the undeveloped and urgently needed area of using small data samples of strongly disturbed data for efficient decision making. The solution of this problem under incomplete and uncertain observations, which seems to be a utopia from the point of view of the contemporary prevailingly asymptotic theory of mathematical statistics (and which can be observed in the Nature on each step) was, at least partially, achieved by the gnostic theory. This is a consequence of choosing a fundamentally different way of characterizing uncertain data to the approach of mathematical statistics. The proposed model understandably does not aspire to universal application, although it, as it seems, can cover a considerable portion of the field of "physically" modelled data. I consider the originality of the author's approach as the most important achievement, which can become a source of inspiration for further solutions of the problems of small data samples.

2.2 RNDr. Petr Burian, CSc.:[5]

The submitted doctoral dissertation "Gnostic theory of uncertain data" deals with the solution of a current and pressing scientific problem, the creation of a new theory applicable to the handling of small data samples contaminated by strong information noise. This problem is especially interesting for the practice of engineering, where it is frequently necessary to make technical or

[4] Author's answer: Additivity of probability distributions results from the composition axiom because of the linear dependence of the probability on the irrelevance.

[5] Head of the Research Institute of the machinery factory ČKD, Prague 9

economical decisions, having a significant economic or social impact, based on a small number of uncertain, but very expensive data.

The dissertation is based on the solutions of a number of problems from the field of informatics, technical cybernetics, algebra and other mathematic fields.

(A concise abstract of the theory follows.)
....

According to the opponent's information, the computing programs based on the theory were applied in many fields of practice, to which the ČKD evidently belonged among the first ones. Gnostic analyzer and identifier had been in use at the opponent's institute since 1986. The largest application of these programs in ČKD Prague dealt with the evaluation of the reliability of the driving axles of locomotives, where the defectoscopic control detected fatigue cracks. A large data collection of nearly 1100 data on axles and cracks was made available for the solution of this problem. This data represented very important information representing a value of 55 million Czechoslovak crowns. However, this data was corrupted by strong information noise due to the spread of material, the technical and operating conditions of the axles, as well as by the human factor in collecting and evaluating the data.

The approach to the treatment of this data was initially reviewed with several respected agencies of mathematical statistics. The data collection was determined to be non-treatable or its repair was deemed unacceptable for the ČKD. Only the willing and active cooperation of the dissertation's author in the treatment of this data, and the implementation of gnostic programs into the Research Institute of ČKD and the adaptation of them to the special data characteristics, enabled the socially and economically important information on the conditions of acceptability of the fatigue cracks in axles to be delivered to the producer and users of the locomotives.

The opponent wishes to comment in this context on a frequent objection of some statisticians when results of the gnostic theory are presented. They claim, that the practioners only require "a number" from the data analysis. without concern for the use of the correct method. In the case of the fatigue cracks data treatment, which is the largest data collection yet treated by gnostic methods, it was possible to compare the estimates made by the Gnostic analyzer on the „survival" times of axles with cracks and the decisions made with those estimates with the actual behaviour of several axles, which failed in practice. It was possible to establish a surprisingly high correlation between the estimated and actual lifespans of these axles.

2.3 Prof. RNDr. Ivo Marek, DrSc.: [6]

Information was always a significant component of the existence of human society and its treatment and usage influences the development of society in general. It is self-evident, that such a conspicuous component of the society's consciousness has its natural relations. Different models were developed on the way to their recognition. Such models are prevailingly of the

[6] Head of the department of Numeric Mathematics of the Charles University, Prague

statistical and probabilistic nature, the consequence of which automatically suppresses the individuality of discrete components of information, of the individual data. The rigor of the statistical approach is dependent on *a priori* assumptions on data samples, which even includes roughly speaking, the size of the data sample. Mathematical statistics did not create suitable means for the handling of small samples especially because its investigative means are prevailingly of an asymptotic nature. The progress toward small data samples is thus desirable. These problems are decisively urgent, important and needed.

The goal of the considered dissertation author's is to create the data theory capable of bridging some flaws of the statistical models. He comes with a new non-statistical concept of data theory based on the original philosophical ideas enabling the uncertainty of individual data to be quantified.

This new gnostic theory is build up by means of the mathematic apparatus, the fundamental notions of which are notions of the theory of the representation of finite groups. The mathematical model in the author's conception is an algebra of representations of a final group. In the framework of such structures, it is thus possible to vividly interpret the data, their uncertainty, data composition, etc.
The applied mathematical apparatus is developed enough to enable other needed notions and operations to be modelled. My subjective preference is the matrix representation before the double numbers in spite of the redundancy of matrix models.

The introduced mathematic apparatus further enables gnostic events and quantification and estimation operators to be modelled. Further notions then follow including gnostic entropy and information of an individual data item. Gnostic theory does not introduce only its "own" notions. It is even possible to model within its framework notions coinciding with the original statistical ones in cases where the necessary assumptions of the asymptotic theory are satisfied. In contrast to the statistical approaches, the application of such notions and their interrelations are rigorous in the framework of the gnostic theory independent of their validity in statistical theories. Gnostic theory is thus a natural extension of the theories based on the asymptotic statistics.

The dissertation contains a large number of new results and it is not the task of the opponent to compose a complete list of these. The dissertation's author made it in his presentation in pp.34-35. In the role of the opponent, I concentrate on the formal mathematical statements of the dissertation.

The author acheived his goal by building up his gnostic theory. In contrast to many other dissertations to which I was an opponent, the dissertation in question manifests distinct innovative features. The author is aiming to negate, in a certain sense, some classical approaches and thus runs the risk, which is more psychological than purely professional; that he must fight for his theory more than the authors of dissertations based on established methods and generally accepted "ideology". The author had to pass through conflicts with some strict adherents of classical methods. Always using some adequate means in these cases does him credit.

I again emphasize that this dissertation characterizes its author as a scientific personality in a measure exceeding my experience. The dissertation is of high quality and is inspiring in both conception and details. It brings the theory, which is on the first side elegant and thus beautiful and clean and on the other side broadly applicable to data samples without limitations of their sizes while respecting further necessary requirements, for example the robustness of the estimates. It is an axiomatic theory and as such it suffers from a large number of definitions, the amount of which exceeds the number of proved statements/theorems. However, this happens frequently with axiomatic theories, especially in their primary stages. This should not be taken as a rebuke, but as a challenge to further refine and extend the theory. The model of uncertain data created by the author is probably not universal. In other words, this model is applicable to data possessing of some additional features. These should be further characterized and this is another challenge for further investigation. Such an identification could open, among other things, the way to the solution of the important field of mathematical problems, the analysis of non well-posed problems.

3. PUBLICATIONS RELATED TO MATHEMATICAL GNOSTICS AND ITS APPLICATIONS

1) Baran R.H., Comments on “A New Theoretical and Algorithmical Basis for Estimation, Identification and Control by P.Kovanic”, Automatica 24, No.2, (1988), pp.283-287
2) Novovičová J., M-estimators and Gnostical Estimators of Location, Problems of Control and Information Theory, 18, No.6, (1989), pp.397-407
3) Novovičová J., M-estimators and Gnostical Estimators of Location, Problems of Control and Information Theory, 19, No.2, (1990), pp.129-140
4) Novovičová J., M-estimators and Gnostical Estimators for Identification of a Regression Model, Automatica 26, No.3, (1990), pp.607-610
5) Šindelář J., Models in Gnostical Theory, International Journal of General Systems, Vol.21, No.4, (1993), pp.363-378
6) Šindelář J., Variational Theorems in Gnostical Theory of Uncertain Data, Kybernetika, Vol.31, No.1, (1995), pp.65-82
7) Kovanic P.: Selected examples of applications of traditional and new data treatment methods, Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1250 (1984),31 pp.
8) Dostálek C., Kovanic P., Kufudaki O., Málková L.: Analysis of latent periods in decreasing learning curves (in Russian), The 8-th International Symposion of the INTERMOZG organization ("Brain and Behavior"), Liblice (1984)
9) Kovanic P.: Data Analysis Software Based on the Gnostical Theory (in English), International conference COMPSTAT '84, Prague (1984)
10) Kovanic P.: Introduction into the gnostic theory (in Czech), Proceedings of the ROBUST conference '84, Faculty of Mathematics and Physics of the Charles University, Prague (1984), 55-60
11) Kovanic P.: Gnostic algorithms for data treatment (in Czech), Proceedings of the ROBUST conference '84, Faculty of Mathematics and Physics of the Charles University, Prague (1984), 60-62

12) Kovanic P.: A program package for minicomputers for gnostic data treatment (in Czech), Proceedings of the 5-th conference on minicomputer technology, Dom techniky (House of Technology), Bratislava (1984), 190-197
13) Kovanic P.: Gnostic monitor of processes (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1278
14) Kovanic P.: Gnostic monitor of processes GM1 for the SINCLAIR ZX-Spectrum computer (in Czech), Datasystém, Bratislava (1985), 20 pp., 5 examples
15) Kovanic P.: Gnostic ~theory of data and its applications (in Czech), Proceedings of the Colloquim "Selected Problems of Simulation", Czechoslovak Scientific and Technological Society, Ostrava (1985), 12-28
16) Kovanic P.: A new theoretical basis for data analysis (in Czech), Automatizace 29 (1986), 4, 90-95
17) Kovanic P., Vlachý J.: Gnostical Analysis of International Activities in Physics (in English), Czechoslovak Journal of Physics B 36 (1986), 71-76
18) Kovanic P., Novovičová J.: A comparison of statistical and gnostical estimates of location parameters on real data (in Czech), Proceedings of the "ROBUST" conference '86, Faculty of Mathematics and Physics of the Charles University, Prague (1986), 60-64
19) Kovanic P.: Recent state of the development of the gnostic algorithms (in Czech), Proceedings of the "ROBUST" conference '86, Faculty of Mathematics and Physics of the Charles University, Prague (1986), 64-66
20) Hrdinová D., Kovanic P.: Efficient solutions of the economic problems by means of gnostic algorithms (in Czech), Proceedings of the conference "Application of Mathematic Models and Computers to the Control of National Economy", Economic University Bratislava (1986), 147-148
21) Kovanic P.: Verification of gnostic algorithms on the quality assessment problems (in Czech), Proceedings of the conference "Application of Mathematic Models and Computers to the Control of National Economy", Economic University Bratislava (1986), 243-244
22) Kovanic P.: Gnostic monitor of probability GM3, project and program (in Czech), Datasystém, Bratislava (1986)
23) Kovanic P., Pacovský J.: Robust Filtering and Fault Diagnosis by Gnostical Methods (in English), Proceedings of the X-th World Congress IFAC 1987 on Automatic Control, IFAC, Munich (1987), Vol.3, 86-90
24) Kovanic P., Novovičová J.: On Estimators Worth to be Applied to Real Data (in English), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1463 (1987), 14 pp.
25) Kovanic P., Kaprál R.: Gnostic monitor of processes GM1 (in Czech), Proceedings of the conference "Mini- and Macrocomputers '86", Part III, Czechoslovak Scientific and Technology Society, Prague (1986), 280-286
26) Kovanic P.: Gnostic data treatment, Chemický průmysl (The Chemical Industry) 37/62 (1987), 8, 434-435
27) Kovanic P., Kučera V.: Prospects of academic cooperation with the nuclear power-plant engineering (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1433 (1987), 19 pp.

28) Kovanic P. and col.: Reliability of the presurized water reactors, Joint workshop of the Czechoslovak Academy of Sciences and ŠKODA Co., MODRA '87, (1987), Modrá near Bratislava
29) Kovanic P.: Gnostic analyzer ~GA1E, program and guide (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences (1987), 60 pp.
30) Kovanic P.: GSP1 - Library of the gnostic procedures (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences (1987), 74 pp.
31) Kovanic P.: A simulation comparison of robustness of the estimators of location, Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1491 (1987), 28 s.
32) Kovanic P.: Robust homogeneity testing of small data samples, Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1942 (1987), 37 pp.
33) Kovanic P.: Simulation of empirical events (in Czech), Proceedings of the 22-th spring colloquium "System Simulation and Mathematical Methods", Czechoslovak Scientific and Technological Society, Ostrava (1988), 41-46
34) Kovanic P.: Gnostic analysis of the economics of the chemical industry in USA and Czechoslovakia in 1986 (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1520 (1988), 26 pp.
35) Kovanic P.: Gnostic filter for the control of a rotating furnace (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1521 (1988), 13 pp.
36) Kovanic P.: Application of gnostics to identification of non-idealized systems (in Czech), Proceedings of the KASIM 833 conference, Czechoslovak Scientific and Technological Society, Pilsen, (1988), 49-57
37) Kovanic P.: Gnostic theory of uncertain data (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1542 (1989), 144 pp., 15 figs.
38) Kovanic P.: Gnostic analysis of the economics of chemical industry (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1579 (1989), 38 s.
39) Kovanic P.: Applied Gnostics (in English), Conference of the IAEA "From Data to Model", Laxenburg, Austria (1991)
40) Kovanic P.: Gnostic diagnostics (in Czech), Colloquium "Software of Diagnostic Systems of Nuclear Power Plants", ŠKODA Co., Pilsen (1989)
41) Kovanic P.: Program and guide of the gnostic analyser GA2, Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1633 (1989), 38 pp., Appendix 29 pp.
42) Kovanic P.: Program and guide of the gnostic identifier of processes GIP, Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1640 (1990), 13 pp., App. 22 pp.
43) Kovanic P.: Gnostical Approach to Robust Control (in English), Joint British -- Czechoslovak conference "Advanced Methods in Adaptive Control for Industrial

Applications", Prague, May 14 - 16 (1990), 4 pp., 8 Figs. Published in Lecture Notes in Control and Information Sciences 158, Springer--Verlag N.Y. (1991)
44) Kovanic P.: Optimization Problems of Gnostics (in English), Conference "Optimization - Based Computer - Aided Modelling and Design", Hague, April 2 - 4 (1991) and in Lecture Notes in Control and Information Sciences 174, Springer--Verlag (1992), 158--167
45) Paukert T., Rubeška I., Kovanic P.: A New Look at Analytical Data Through the Gnostical Analyser (in English), The Analyst, 118, Febr. 1993, 145--148
46) Kovanic P., Volf P.: Program GI5: Gnostic identifier of a survival model (in Czech), Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1725 (1991), 18 pp.
47) Kovanic P.: Guide for the program GI4 (Gnostic identifier of a linear regression model) Report of the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences No.1743 (1992), 18 pp., App. 10 pp.
48) Kovanic P.: Gnostic models (in Czech), Proceedings of the MOSIS'92 colloquium, Acta MOSIS No.48, Dům techniky (Technology House) (1992), 62--65
49) Kovanic P., Bőhm J.: Robust PID -- Control (in English), IFAC Workshop on Mutual Impact of Computing Power and Control Theory, Prague, Preprints MICC'92 (1992) 235--237
50) Kovanic P.: Robust estimates of distribution functions (in Czech), Proceedings of the ROBUST conference '92, Faculty of Mathematics and Physics of the Charles University, Prague (1992)
51) Kovanic P., Volf P.: Robust identification of Reliability models (in Czech), Proceedings of the ROBUST conference '92, Faculty of Mathematics and Physics of the Charles University, Prague (1992)
52) Kovanic P.: A new model of surviving (in Czech), Proceedings of the XIV-th Moravian colloquium "Selected Problems of Simulation Models", MARQ, Ostrava (1992), 31--34
53) Kovanic P., Kolář P.: An example of application of a gnostic model to investment decisions (in Czech), Akcionář (Investor) III., No.20 (1992), 8--9
54) Kovanic P., Kovanicová D.: How the share prices should (not) be estimated (in Czech), Akcionář (Investor) III., No.23 (1992), 8--9
55) Kovanic P.: Gnostical Models of Economics (in English), International Conference MOSIS'93, MARQ, Ostrava (1993)
56) Kovanic P., Žofková I.: Medical Experience with Small Data Samples Processing (in English), Second European Congress on System Sciences, Prague, Oct. 5--8, 1993
57) Kovanic P.: Financial statement analysis, chapter 20 of the book D.Kovanicová, ABC of accounting knowledge for everybody (in Czech), Trizonia, Prague (1993), 259--290 (Upgrades of this book along with the chapter 20 were republished by the publishing house Polygon, Prague in 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002 and 2003.
58) Kovanic P., Kovanicová D.: Do you have confidence in the mean values? (in Czech), Akcionář (Investor) IV., No. 6 (1993), 8--9
59) Kovanic P., Kolář P.: Selected results of financial analysis of building industry and geology in the former Czechoslovakia, Hospodářské noviny (The Economic News, Prague) No. 49 (March 11, 1993), 15

60) Kovanic P., Kovanicová D.: Financial ratios as erratic boulders (in Czech), Akcionář (Investor) IV., No. 7 (1993), 8--9
61) Kovanic P., Humber M.B.: A New Paradigm for Econometrics (in English), The Third International Workshop on Artificial Intelligence in Economics and Management, Portland, Oregon, U.S.A., August 25--27, 1993
62) Kovanic P., Kolář P.: Selected results of the financial statement analysis of the Paper and Forest Industry (in Czech), Hospodářské noviny (The Economic News, Prague), No. 49 (March 11, 1993), 15
63) Kovanic P.: Gnostical Modelling of Uncertainty (in English), MTNS '93 -- International Symposium on the Mathematical Theory of Networks and Systems, August 2-6, 1993, Regensburg, Germany
64) Kovanic P.: Intelligent Load Monitoring and Forecasting System (in English), SIMONE - International Workshop on Gas Distribution Systems, Prague, Sept. 1993, Proceedings 157-160
65) Kovanic P.: Gnostic filtration of acoustic signals (in Czech), Development and research project ordered by a Czech Ministry (1993), 23 pp.
66) Kovanic P.: Gnostical Analysis of the Cleanroom-like Data (in English), Interim report on research project ordered by the Digital Equipment Corporation (DIGITAL) in Vienna, (1993), 22 pp. 27 figs.
67) Kovanic P., Barack R.A.: Robust Survival Model as an Optimization Problem (in English), The 16-th IFIP Conf. on System Modelling and Optimization, Compiégne, France, July 5-9, 1993, Proceedings Vol.2, 831-843
68) Kovanic P., Barack R.A.: Gnostic Analyzer GA5.2 for Windows, Commercial Program (in English), M.M.Consult, Prague (1994)
69) Kovanic P., Michajlov M.: Guide to the gnostic analyzer GA5.2 for Windows (in Czech), M.M.Consult, Prague (1994), paper version 118 pp., on-line help 11083kB
70) Kovanicová D., Kovanic P.: How the Czech Chemical Industry performs? (in Czech), Hospodářské noviny (The Economic News, Prague), (September 1, 1994) No.171/94, p.11
71) Kovanicová D., Kovanic P.: What can be found out about firms from their accounting? Supplement of the journal Kuponová privatizace (Coupon Privatization) 3, No.26 (August 10, 1994), 1--17
72) Kovanic P.: Gnostic treatment of acoustic and thermovision signals (in Czech), Development and research project ordered by a Czech Ministry (1994), 22 pp.
73) Kovanic P.: Gnostical Analysis of the Cleanroom-like Data (in English), Final report on research project ordered by the Digital Equipment Corporation (DIGITAL) in Vienna, (1994), 13 pp. 34 figs.
74) Kovanicová D., Kovanic P.: Time of the financial statement analysis came (in Czech), Finanční analýza (Financial Analysis) No.0, (1995), 2-4
75) Kovanicová D., Kovanic P.: Financial ratios---tools of the financial statement analysis (in Czech), A Guide for the Czech Stock Market, Aspekt Kilcullen, No.1 (1995), 61-62
76) Kovanicová D., Kovanic P.: Recent problems of the financial statement analysis (in Czech), Daňový a účetní poradce podnikatele (Tax- and Accountancy Adviser for Enterpreneurs), No.7 (1995), 61-96

77) Kovanic P.: Robust treatment of acoustic and thermovision signals (in Czech), Development and research project ordered by a Czech Ministry (1995), 22 pp.
78) Kovanicová D., Kovanic P.: Mathematical methods of financial statement analysis (in Czech), Finanční analýza (Financial Analysis) No.1 (1996), 7-11
79) Kovanicová D., Kovanic P.: Superstitions and misleading of financial analysts and how to resist (in Czech), Finanční analýza No.3 (1996), 44-47
80) Kovanicová D., Kovanic P.: Treasures hidden in accountancy (in Czech), Part II.: "Financial statement analysis", Polygon, Prague:
- 1-st edition (1995), ISBN 80-85967-07-03, 300 pp.
- 2-nd edition (1996), ISBN 80-85967-07-3, 300 pp.
- 3-rd edition (1997), ISBN 80-85967-56-1, 303 pp.
- 4-th edition (1999), ISBN 80-85967-88-X, 303 pp.

81) Kovanicová D., Kovanic P.: Treasures hidden in accountancy (in Czech), Part III.: "Financial control of the growth rate of a firm", Polygon, Prague
- 1-st edition (1996), ISBN 80-85967-35-9, 280 pp.
- 2-nd edition (1997), ISBN 80-85967-58-8, 280 pp.

82) Kovanicová D., Kovanic P.: High-tech for Financial Statement Analysis (in English), Proceedings of the 19-th Annual Congress of the E.A.A., N.H.H. Bergen, Norway (1996), Abstracts, p.328, full text 28 pp.
83) Kovanicová D., Kovanic P.: Superstitions and misleading of financial analysts and how to resist (in Czech), Proceedings of the VIII-th international conference on statistical methods in Bank Industry, Financial Services and Insurance, Donovaly May 8--10, 1996, Slovak Statistical and Demographical Society (1996), 115-120
84) Kovanic P., Humber M.B.: Economics of Information by Using the Mathematical Gnostics (in English), Part I., Applications, Invited lecture in George Washington University, Washington, D.C., February 13, 2003, Microsoft Power Point Presentation 2094 kB
85) Kovanic P.: Economics of Information by Using the Mathematical Gnostics (in English), Part II., Introduction to the Theory, Invited lecture in George Washington University, Washington, D.C., February 20, 2003, Microsoft Power Point Presentation 764 kB
86) Kovanic P., Humber M.B.: The Economics of Information---Mathematical Gnostics for Data Analysis, book 707 pp., http://math-gnostics.com/download/MG19.pdf
87) Kovanic P., Ocelka T., Grabic R., Rieder M.: Gnostic Analysis: A Novel Approach for Univariate and Multivariate Data Analysis. Applications to Experimental Data from Monitoring and Research, IIIS Copyright Manager , 14269 Lord Barclay Dr., Orlando, Fl. 32837, USA, The 9-th World Multi-Conference on Systemics, Cybernetics and Informatics WMSCI 2005, Vol. VI, pp.289-264
88) Ocelka T., Kovanic P., Gnostic Analysis, Applications to Experimental Data from Monitoring and Research, Workshop of the EU project MAGIC, Frýdek-Místek (2006)
89) Kovanic P., Ocelka T., Maximum Information from Small Data, (in Czech), National conference on permanent organic pollutants, Strážnice, Czech Republic (2007)
90) Kovanic P., Ocelka T., Comparison of Samplers, 2-nd International Passive Sampling Workshop, Bratislava (2006)

91) Kovanic P., Ocelka T., Review and Tests of Data Treatment Methods, Annual Meeting of the 2-FUN project EU, Lisboa, Portugal (2008)

92) Kovanic P. Ocelka T., Mathematical Gnostics: Advanced Data Analysis, semi-anual meeting of the FOKS project, April 1. 2009, Trevizo, Italy

93) Kovanic P., Ocelka T.: Problems of Intercalibration, International Passive Sampling Interlaboratory Comparison, April 2010, Prague

94) Kovanic P., Ocelka T., Ciffroy P., An alternative approach to handle non-detectable values in datasets obtained in environmental and health monitoring, submitted for publication (2009).

95) Kovanic P., Ocelka T., Loading of POPs in Czech People, (Loading of POPs.pps), Annual Meeting of the 2-FUN project EU, Prague (2009)

96) Kovanic P., Ocelka T., Advanced Analysis of Uncertain Data, (Advansci.pps), Meeting of the FOKS project of the EU, Treviso, Italy (2009)

97) Kovanic P., Bubak A.: Contamination and Morbidity, the 3-d Annual Meeting of the 2-FUN project, Venice, 17.-19. February 2010

98) Kovanic P., Ocelka T., Pavliska L.: Necessity of Alternative Methods (in Czech), seminary Ekomonitor, Žďár n.S., (2010)

99) Kovanic P.: Comments to Stuttgart data (Comments.pdf), report of the FOKS project, 12.pp. (February 2011)

100) Kovanic P.: Applications of Gnostic Distribution Functions, Workshop of the FOKS-project, Ostrava, February 2011

101) Kovanic P.: Data Stuttgart, presentation for the meeting of the FOKS project, 30.-31.3.2011, Katowice, Poland

102) Kovanic P., Pavliska L., Ocelka T.: Mathematical Gnostics, contribution to the Toolbox FOKS, (2011), 35.pp.

103) Kovanic P., Pavliska L., Ocelka T.: News in Passive Sampling, International Passive Sampling Workshop, Krakow, Poland, 11 - 14. May 2011

104) Kovanic P., Pavliska L., Ocelka T.: Advances in Data Treatment, Brokerage Event 2011, Ostrava

105) Kovanic P. Pavliska L., Ocelka T.: Data Analysis in the FOKS-project (in Czech), Final workshop of the FOKS project, Prague (2012)

106) Pavliska L., Kovanic P., Ocelka T.: Data Analysis from Jaworzno, (FOKS_JAW1_finalConference.pdf), Final FOKS Conference in Katowice (2012)

107) Rucka, Z., Koutna, I., Tesarova, L., Potesilova, M., Stejskal, S., Simara, P., Vanhara, P., Kovanic, P., Dolezel, J., Zvonicek, V., Capov, I.: The effects of intensive insulin therapy on pulmonary diffusion and pulmonary-associated surfactant genes in non-tumor tissue in lung carcinoma patients, Masaryk University Brno and St. Anne's University Hospital Brno, submitted for publication (2012)

108) Prochazka V., Klosova H., Stetinsky J.[3]Gumulec J., Vitkova K., Salounova D., Dvorackova J., Bielnikova H., Klement P., Levakova V., Ocelka T., Pavliska L., Kovanic P., Klement GL: Addition of platelet concentrate to Dermo-Epidermal Skin Graft in deep burn trauma reduces scarring and need for revision surgeries, Faculty Hospital Ostrava and all., submitted for publication (2012).

109) Kovanic P.: Metric -- the Achilles Heal of Mathematical Statistics. Robust Quantification of Uncertainty. (2012) , unpublished

110) Ždímal V., Brabec M., Wagner Z.: Comparison of Two Approaches to Modeling Atmospheric Aerosol Particle Size Distributions. (Eng) Aerosol Air Quality Res. 8(4), 392-410 (2008).
111) Wagner Z., Schwarz J., Ždímal V., Eleftheriadis K., Lazaridis M., Smolík J.: Analysis of Time Evolution of Particle Size Distribution. (Eng) 18th International Conference Nucleation and Atmospheric Aerosols, Book of Abstracts, pp. 116-119, Prague, Czech Republic, 10-14 August 2009.
112) Ždímal V., Smolík J., Eleftheriadis K., Wagner Z., Housiadas Ch., Mihalopoulos N., Mikuška P., Večeřa Z., Kopanakis I., Lazaridis M,.: Dynamics of Atmospheric Aerosol Number Size Distributions in the Eastern Mediterranean During the "SUB-AERO" Project. (Eng) Water Air Soil Pollut. 214(1-4), 133-146 (2011).
113) Morávková L., Wagner Z., Linek J.: Volumetric Behaviour of Binary Liquid Systems Composed of Toluene, Isooctane and Methyltert-Butyl Ether at Temperatures from 298.15 K to 328.15 K. (Eng) J. Chem. Thermodyn. 41(5), 591-597 (2009).
114) Morávková L., Wagner Z., Sedláková Z., Linek J.: Volumetric Behaviour of the Ternary Liquid System Composed of Methyl tert-Butyl Ether, Toluene, and Isooctane at Temperatures from 298.15 to 328.15)K. Experimental Data and Correlation. (Eng) J. Chem. Thermodyn. 42(7), 920-925 (2010).
115) Morávková L., Wagner Z., Sedláková Z., Linek J.: Volumetric Behaviour of Binary and Ternary Liquid Systems Composed of Ethanol, Isooctane, and Toluene at Temperatures from (298.15 to 328.15) K. Experimental Data and Correlation. (Eng) J. Chem. Thermodyn. 43(12), 1906-1916 (2011).
116) Bendová M., Wagner Z.: Liquid-Liquid Equilibrium in Binary System [bmim][PF6] + 1-Butanol. (Eng) J. Chem. Eng. Data 51(6), 2126-2131 (2006).
117) Bendová M., Wagner Z., Moučka M.: Liquid-Liquid Equilibrium in Binary System 1-Butyl-3-Methylimidazolium Hexafluorophosphate + Water. Experiment and Data Correlation. (Eng) Int. J. Thermodyn. 11(3), 109-114 (2008).
118) Bendová M., Wagner Z.: Thermodynamic Description of Liquid-Liquid Equilibria in Systems 1-Ethyl-3-methylimidazolium Ethylsulfate + C7-Hydrocarbons by Polymer-Solution Models. (Eng) Fluid Phase Equilib. 284(2), 80-85 (2009).
119) Setničková K., Wagner Z., Noble R., Uchytil P.: Semi-Empirical Model of Toluene Transport in Polyethylene Membranes Based on the Data Using a New Type of Apparatus for Determining Gas Permeability, Diffusivity and Solubility. (Eng) J. Membr. Sci. 66(22), 5566-5574 (2011).
120) Z. Sedláková and Z. Wagner: High-Pressure Phase Equilibria in Systems Containing CO2 and Ionic Liquid of the [Cnmim][Tf2N] Type. Chem. Biochem. Eng. Q. 26 (1) XX-XX (2012)
121) Smolík J., Ždímal V., Wagner Z., Eleftheriadis K., Lazaridis M., Colbeck I.: Submicrometer Particle Number Size Distributions of Atmospheric Aerosol in the Mediterranean Area. (Eng) European Aerosol Conference EAC 2001, Book of Abstracts [in J. Aerosol. Sci., 32 (Suppl. 1), S145-S146 (2001)], Leipzig, Germany, 03-07 September 2001.
122) Wagner Z., Ždímal V., Smolík J.: Robust Estimation of Particle Size Distribution in Atmospheric Aerosols by Gnostic Theory. (Eng) International Chemometrics Meeting Chemstat 2004, Conference Proceedings, p. 76-84, Pardubice, Czech Republic, 30 August - 02 September 2004

123) Eleftheriadis K., Ždímal V., Wagner Z., Vratolis S.: Performance Comparison of SMPS and LAS-X using Ammonium Sulphate and Sodium Chloride Aerosol. (Eng) European Aerosol Conference EAC 2005, Book of Abstracts, p. 297, Ghent, Belgium, 28 August - 02 September 2005.

124) Ždímal V., Schwarz J., Wagner Z., Dohányosová P., Smolík J.: The Dynamic of Atmospheric Aerosol Number Size Distributions at a Suburban Site in Prague. (Eng) European Aerosol Conference EAC 2005, Book of Abstracts, p. 713, Ghent, Belgium, 28 August - 02 September 2005.

125) Eleftheriadis K., Vratolis S., Housiadas C., Smolík J., Ždímal V., Schwarz J., Wagner Z., Lazaridis M., Ondráček J., Hussein T., Kephalopoulos S., Drossinos Y.: Modal Structure of the Fine Urban Aerosol in Four European Cities. (Eng) 7th International Aerosol Conference, Proceedings, p. 1786, St. Paul, Minnesota, USA, 10-15 September 2006.

126) Matějková D., Ždímal V., Dohányosová P., Wagner Z., Smolík J.: Benchmark Tests of SMPS. (Eng) NOSA 2006 Aerosol Symposium, Book of Abstracts, pp. 229-233, Helsinki, Finland, 08-10 November 2006.

127) Hovorka J., Ždímal V., Schwarz J., Wagner Z., Dohányosová P., Braniš M., Smolík J.: Seasonal Variation of Submicron Aerosol Number Size Distributions at Urban and Suburban Sites of Prague in 2004/2005. (Eng) European Aerosol Conference, Program and Abstracts, p. T13A229, Salzburg, Austria, 09-14 September 2007.

128) Zíková N., Wagner Z., Schwarz J., Smolík J., Ždímal V.: One-year SMPS Measurements at Background Station Košetice - Basic Statistics. (Eng) International Aerosol Conference IAC 2010, Registration Handbook, P3LP12, Helsinki, Finland, 29 August - 03 September 2010.

129) Zíková N., Wagner Z., Schwarz J., Smolík J., Ždímal V.: Diurnal Cycles of Aerosol Particle Number Size Distributions in Relation to Meteorology and Gaseous Pollutants. (Eng) EUCAARI Annual Meeting 2010, Presentation Abstracts, Helsinki, Finland, 22-26 November 2010.

130) Zíková N., Wagner Z., Schwarz J., Smolík J., Ždímal V.: Rozdělení velikosti aerosolových částic na stanici Košetice - základní statistika roční řady měření spektrometrem SMPS. (Czech) Aerosol Number Size Distribution in Košetice Observatory - Basic Statistic of One-Year SMPS Measurement . XI. Konference České aerosolové společnosti, Sborník konference, pp. 29-30, Praha, Czech Republic, 18-19 November 2010.

131) Pískovský T., Lochmanová A., Ocelka T., Pavliska L., Veselková Z., Michálek J.: Regulatory CD4+CD25+ T-lymphocytes in Children with Juvenile Idiopathic Arthritis, University Hospital Ostrava, submitted for publication (2012)

132) Knizek J., Sindelar J., Pulpan Z., Vojtesek B., Nenutil R., Brozkova J., Drazan V., Hubalek M., and Beranek L.: Test of the Hypothesis That One Group of Dependences is Consistent with Another Group of Dependences, *Bulletin of Statistics & Economics,* Autumn 2008;
Volume 2; Number A08, 18 pp.

133) Knizek J., Beranek L., Bouchal P., Vojtesek B., Nenutil R. and Tomsik P.: Gnostic Solution of the Marker Statistics' Problem with Occurence of Tested Phenomena's Outlying Behavior, International Journal of Ecological Economics & Statistics (IJEES), Vol.29, No.2 (2013), 35-60