

CURRICULUM VITAE

Rudolf Kulhavy

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CURRENT RESEARCH INTERESTS

Decision support to business design and business model innovation.
Categorical foundation of economic decision analysis.

WORKSHOP EXPERIENCE

6/2020–present **Research Associate** (part-time)

6/2018–12/2018 Institute of Information Theory and Automation of the CAS, Prague, Czech Republic
Non-university public research institution

Research on quantitative methods in strategic management, with special focus on modeling and optimizing the process of value creation and capture. Topics of particular interest include probabilistic modeling of the resource conversion and exchange dynamics, capturing the compositional structure of extended value chains using category-theoretic means (such as monoidal categories and operads), multi-stage decision-making under uncertainty, simulation-based approximations of inference and optimization, analysis and design of reusable patterns of value creation, and probabilistic functional programming.

6/2018–present **Founder**

Forescope, Prague, Czech Republic
Niche technology and consulting startup

A niche startup that aims to create a convenient platform for business decision makers to analyze their resource allocation decisions well before possibly implementing them. The project focuses in particular on situations when decision makers must deal with inherently risky opportunities but have enough room to act through their realization—in response to new information as it becomes available. To this end, the project develops modeling, simulation, and optimization methods (capable of accounting for the dynamics, uncertainty, and managerial flexibility in resource allocation) as well as prefab, reusable models of frequently met patterns of value creation. On top of the platform, premium services are offered, including development of problem-specific valuation models and coaching on business value assessment.

6/2018–2/2021 **Independent Consultant**

Self-employed

Advised on strategic decisions related to technology and business innovation while building upon:

- Extensive IT consulting experience covering business analysis, data modeling, data warehousing, predictive modeling, enterprise architecture, cloud computing, and IT strategy.
- Multiple industry knowledge, including banking, insurance, government, energy, utilities, and manufacturing.
- Applied math background in modeling, simulation, and optimization of dynamical systems under uncertainty, with particular focus on business dynamics simulations and decision analysis.

10/2004 – 5/2018

Senior Consultant

IBM Global Technology Services, Prague, Czech Republic
Global supplier of information technology products and services

Served as a technical presales and go-to-market consultant and solution design specialist in financial services and public sectors. Architected business intelligence solutions in multiple industries, with special focus on banking and insurance. Designed analytical solutions for credit scoring, internal risk models, customer behavior analysis, and financial management. Valued strategic initiatives subject to essential uncertainty using real options analysis. Served as a lead business analyst in multiple proposals and projects. Developed numerous functional, data, process, and service models using publicly available as well as IBM industry-specific patterns. Since 2016, served on the global Infrastructure Services consulting team, as a focal point for hybrid cloud services in Central & Eastern Europe.

Selected accomplishments:

- Conducted real options analysis in a leading Czech retail bank to value a portfolio of strategic projects with a net present value of over 1 billion CZK. Advised on governance of innovation activities.
- Developed a comprehensive business domain model of a leading Czech building society to support a new core system integration while building upon the resource-event-agent enterprise ontology.
- Developed functional models of all or selected business capabilities in leading Czech retail banks and insurance companies to support major investment decisions and process optimizations.

3/1996 – 9/2004

Team Leader and Senior Fellow

Honeywell Laboratories, Prague, Czech Republic
Global diversified technology and manufacturing company

Founded and led a cross-functional team of 10+ professionals within Honeywell Laboratories covering research and development, rapid prototyping, and pilot applications of new technologies in exploratory data analysis, predictive modeling, and data-driven process enhancement. Identified disruptive technologies with strong potential for reuse. Architected a suite of decision support tools applicable across multiple Honeywell businesses, with pilot installations in the Czech Republic, Netherlands, Italy, PRC, South Africa, and USA. Cooperated globally with other teams within Honeywell Laboratories. Coordinated transfer of new technologies to Honeywell divisions.

Selected accomplishments:

- Received Innovation Award (with Zdeněk Schindler) at PowerGen Europe Conference, Helsinki, Finland in 2000.
- Received Honeywell Technical Achievement Awards in 2001 and 2004.
- Was appointed a Senior Fellow of the \$8B Automation & Control Solutions business group in 2003.

9/1991 – 8/1992

SERC Visiting Fellow

Control System Centre
University of Manchester Institute of Science and Technology, Manchester, UK
Public research university

Conducted research on statistical modeling of complex manufacturing processes in a one-year project funded by the UK Science & Engineering Research Council.

6/1985 – 12/2009

Research Associate (since 3/1996 part-time)

Institute of Information Theory and Automation of the CAS, Prague, Czech Republic
Non-university public research institution

Conducted research on statistical modeling and decision-making under uncertainty, with

special focus on modeling and optimization of complex dynamical systems. Worked on diverse topics, incl. parameter tracking in adaptive control, information geometry of approximate Bayesian estimation, decision support combining memory-based learning and stochastic optimization with real-time data warehousing, and probabilistic modeling of the dynamic behavior of business networks.

Participated in managing research activities as a member and chairman of the Scientific Council of the Institute, a deputy head of the Department of Adaptive Systems, a secretary of the Czech Committee for Automatic Control (representing the Czech Republic in the International Federation for Automatic Control – IFAC), and a principal investigator of numerous projects funded by the EU and Czech grants.

Selected accomplishments:

- Published over 50 refereed publications, incl. conference papers, journal articles, and chapters in books. Authored the monograph “Recursive Nonlinear Estimation: A Geometric Approach” (Springer, London 1996).
- Won Young Author Prize at the 11th World Congress of the International Federation of Automatic Control (IFAC), Tallinn, Estonia in 1990 and several Best Paper Prizes at IFAC and IEEE conferences.
- Gave invited lectures at multiple events, incl. IFAC Symposium on Adaptive Systems in Control and Signal Processing, Budapest, Hungary in 1995 (plenary lecture); European Control Conference, Brussels, Belgium in 1997 (semi-plenary lecture); NATO Advanced Study Institute on Learning Theory and Practice, Leuven, Belgium in 2002; Hamilton Institute, National University of Ireland, Maynooth in 2009.

EDUCATION AND QUALIFICATIONS

10/2006–6/2007 **University of Economics, Prague, Czech Republic**

Postgraduate course: Fundamentals of Insurance

10/2005–6/2006 **University of Economics, Prague, Czech Republic**

Postgraduate course: Monetary Economics and Banking

11/1996

Czech Academy of Sciences, Prague, Czech Republic

Degree: Doctor of Science (DrSc.)

Field: Technical Cybernetics

11/1985

Czechoslovak Academy of Sciences, Prague, Czechoslovakia

Degree: Doctor of Philosophy (CSc.)

Field: Technical Cybernetics

6/1981

Czech Technical University, Prague, Czechoslovakia

Degree: Master of Science (Ing.)

Major: Electrical Engineering

Minor: Automatic Control

PUBLISHED BOOKS

- Kulhavý, Rudolf. 1996. Recursive Nonlinear Estimation: A Geometric Approach. *Lecture Notes in Control and Information Sciences* 216. London: Springer.

CHAPTERS IN BOOKS

- Kulhavý, Rudolf. 2003. “Bayesian Smoothing and Information Geometry.” In *Advances in Learning Theory: Methods, Models and Applications*, edited by Johan Suykens, Gábor Horváth, Sankar Basu, Charles Micchelli, and Joos Vandewalle, 319–40. NATO Science Series III: Computers & Systems Sciences 190. Amsterdam: IOS Press.

- Kulhavý, Rudolf. 2000. "Randomized Algorithms for Control and Optimization." In *Automation, Control and Complexity: An Integrated Approach*, edited by Tariq Samad and John Weyrauch, 97–114. Chichester, UK: Wiley.
- Kárný, Miroslav, and Rudolf Kulhavý. 1988. "Structure Determination of Regression-Type Models for Adaptive Prediction and Control." In *Bayesian Analysis of Time Series and Dynamic Models*, edited by James C. Spall, 313–45. New York: Marcel Dekker.

JOURNAL PAPERS

- Kulhavý, Rudolf. 2003. "A Developer's Perspective of a Decision Support System." *IEEE Control Systems* 23 (6): 40–49.
- Kulhavý, Rudolf, and Petya Ivanova. 1999. "Quo Vadis, Bayesian Identification?" *International Journal of Adaptive Control and Signal Processing* 13 (6): 469–85.
- Kulhavý, Rudolf, and František J. Kraus. 1996. "On Duality of Regularized Exponential and Linear Forgetting." *Automatica* 32 (10): 1403–15.
- Kulhavý, Rudolf. 1993. "Implementation of Bayesian Parameter Estimation in Adaptive Control and Signal Processing." *The Statistician* 42 (4): 471–82.
- Kulhavý, Rudolf, and Martin B. Zarrop. 1993. "On a General Concept of Forgetting." *International Journal of Control* 58 (4): 905–24.
- Kulhavý, Rudolf. 1992. "Recursive Nonlinear Estimation: Geometry of a Space of Posterior Densities." *Automatica* 28 (2): 313–23.
- Kulhavý, Rudolf. 1990. "A Bayes-Closed Approximation of Recursive Non-Linear Estimation." *International Journal of Adaptive Control and Signal Processing* 4 (4): 271–85.
- Kulhavý, Rudolf. 1990. "Recursive Bayesian Estimation under Memory Limitation." *Kybernetika* 26 (1): 1–16.
- Kulhavý, Rudolf. 1990. "Recursive Nonlinear Estimation: A Geometric Approach." *Automatica* 26 (3): 545–55.
- Kulhavý, Rudolf, and Edvardas Kliokys. 1989. "Tracking of Time-Varying Parameters in Delta Models." *Problems of Control and Information Theory* 18 (2): 163–71.
- Kulhavý, Rudolf. 1987. "Restricted Exponential Forgetting in Real-Time Identification." *Automatica* 23 (5): 589–600.
- Kárný, Miroslav, Alena Halousková, Josef Böhm, Rudolf Kulhavý, and Petr Nedoma. 1985. "Design of Linear Quadratic Adaptive Control: Theory and Algorithms for Practice." *Kybernetika* 21 (Supplement): 3–96.
- Heřmanská, Jindřiška, Zdeněk Prouza, Miroslav Kárný, Eva Maříková, and Rudolf Kulhavý. 1985. Dose Equivalent Determination by Multicomponent Dosimetric Systems. *Kernenergie* 28 (9): 379–383.

CONFERENCE PAPERS

- Kulhavý, Rudolf. 2008. "Modeling of Network Dynamics: From Dynamic Nodes to Dynamic Structure." In *Proceedings of the 26th International Conference of the System Dynamics Society*, Athens, Greece, 20–24 July 2008, 3:1690–1718.
- Kulhavý, Rudolf. 2007. "Bayesian Analysis of Stochastic System Dynamics." In *Proceedings of the 25th International Conference of the System Dynamics Society*, Boston, MA, 29 July–2 August 2007, 4:2374–99.
- Kulhavý, Rudolf. 2002. "Data-Centric Decision Support." In *Proceedings of the 2002 American Control Conference*, Anchorage, AK, 8–10 May 2002, 4:3395–3400.
- Kulhavý, Rudolf, Joseph Lu, and Tariq Samad. 2001. "Emerging Technologies for Enterprise Optimization in the Process Industries." In *Proceedings of the 6th AIChE*

International Conference on Chemical Process Control, Tucson, AZ, 7-12 January 2001, 352-63.

- Schindler, Zdeněk, and Rudolf Kulhavý. 2000. "Data Centric Load Forecasting and Allocation." In *Proceedings of the POWERGEN Europe Conference*, Helsinki, Finland, 20-22 June 2000.
- Ivanova, Petya, and Rudolf Kulhavý. 1999. "A Memory-Based Approach to Fault Detection and Diagnosis." In *Proceedings of the 5th European Control Conference*, Karlsruhe, Germany, 31 August-3 September 1999, 4409-13.
- Kulhavý, Rudolf, and Petya Ivanova. 1999. "Memory-Based Prediction in Control and Optimisation." In *Proceedings of the 14th IFAC World Congress*, Beijing, China, 5-9 July 1999. *IFAC Proceedings Volumes* 32 (2): 4058-4063.
- Ivanova, Petya, and Rudolf Kulhavý. 1998. "Towards the Optimal Design of Nonlinear Predictors Based on Development in Chaos and Wavelet Theories." In *Preprints of the 3rd European IEEE Workshop on Computer-Intensive Methods in Control and Data Processing*, Prague, Czech Republic, 7-9 September 1998, 279-84.
- Kulhavý, Rudolf. 1998. "On Extension of Information Geometry of Parameter Estimation to State Estimation." In *Proceedings of the International Symposium on Mathematical Theory of Networks and Systems*, Padova, Italy, 6-10 July 1998, edited by A. Beghi, L. Finesso, and G. Picci, 827-30.
- Kulhavý, Rudolf. 1998. "On-Line Nonlinear Estimation." In *Preprints of the 3rd European IEEE Workshop on Computer-Intensive Methods in Control and Data Processing*, Prague, Czech Republic, 7-9 Sep 1998, 11-18.
- Kulhavý, Rudolf. 1997. "Approximate Fault Detection and Isolation Using Compressed Data." In *Proceedings of the IFAC Symposium on Fault Detection, Supervision and Safety for Technical Processes*, Kingston upon Hull, UK, 26-28 August 1997. *IFAC Proceedings Volumes* 30 (18): 1005-1010.
- Kulhavý, Rudolf. 1997. "Recursive Nonlinear Estimation of Non-Linear/Non-Gaussian Dynamic Models." In *Computer-Intensive Methods in Control and Signal Processing: The Curse of Dimensionality*, edited by Kevin Warwick and Miroslav Kárný, 1141-67. Boston, MA: Birkhäuser.
- Kulhavý, Rudolf. 1997. "System Identification: From Matching Data to Matching Probabilities." In *Plenary Lectures and Minicourses of the 4th European Control Conference*, Brussels, Belgium, 1-7 July 1997, edited by Georges Bastin and Michel Gevers, 131-60.
- Kulhavý, Rudolf, and Ludvík Tesař. 1997. "On Dual Expression of Prior Information in Bayesian Parameter Estimation." In *Proceedings of the 11th IFAC Symposium on System Identification*, Kitakyushu, Fukuoka, Japan, 8-11 July 1997. *IFAC Proceedings Volumes* 30 (11): 441-446.
- Gacon, David M., Martin B. Zarrop, and Rudolf Kulhavý. 1996. "EM Estimation and Control of Two-Dimensional Systems." In *Proceedings of the UKACC International Conference on Control*, Exeter, UK, 2-5 September 1996, 1:734-39.
- Kulhavý, Rudolf, and František J. Kraus. 1996. "On Duality of Exponential and Linear Forgetting." In *Proceedings of the 13th IFAC World Congress*, San Francisco, CA, 30 June-5 July 1996. *IFAC Proceedings Volumes* 29 (1): 5340-5345.
- Kulhavý, Rudolf. 1995. "A Geometric Approach to Statistical Estimation." In *Proceedings of 1995 34th IEEE Conference on Decision and Control*, New Orleans, LA, 13-15 December 1995, 2:1097-1102.
- Kulhavý, Rudolf. 1995. "A Kullback-Leibler Distance Approach to System Identification." In *Proceedings of the 5th IFAC Symposium on Adaptive Systems in Control and*

Signal Processing, Budapest, Hungary, 14-16 June 1995. *IFAC Proceedings Volumes* 28 (13): 55-66.

- Kulhavý, Rudolf. 1995. "Recursive Nonlinear Estimation Through Global Approximation of Model." In *Proceedings of the 3rd European Control Conference*, Rome Italy, 5-8 September 1995, 2:1273-78.
- Kulhavý, Rudolf. 1994. "Bayesian Estimation, Large Deviations, and Incomplete Data." In *Proceedings of 1994 33rd IEEE Conference on Decision and Control*, Lake Buena Vista, FL, 14-16 December 1994, 1:755-56.
- Kulhavý, Rudolf, and František Hrnčíř. 1994. "Approximation and Uncertainty in Parameter Estimation." In *Proceedings of the European IEEE Workshop on Computer-Intensive Methods in Control and Signal Processing*, Prague, Czech Republic, 7-9 September 1994, 61-70.
- Kulhavý, Rudolf. 1993. "Can Approximate Bayesian Estimation Be Consistent with the Ideal Solution?*" In *Proceedings of the 12th IFAC World Congress*, Sydney, Australia, 18-23 July 1993. *IFAC Proceedings Volumes* 26 (2.5): 303-306.
- Kulhavý, Rudolf. 1993. "Can We Preserve the Structure of Recursive Bayesian Estimation in a Limited-Dimensional Implementation?" In *Proceedings of the International Symposium on Mathematical Theory of Networks and Systems*, Regensburg, Germany, 2-6 August 1993, 1:251-72.
- Kulhavý, Rudolf. 1993. "On Design of Approximate Finite-Dimensional Estimators: The Bayesian View." In *Mutual Impact of Computing Power and Control Theory*, edited by Miroslav Kárný and Kevin Warwick, 13-39. London: Plenum Press.
- Kulhavý, Rudolf, Ivan Nagy, and Jan Spousta. 1992. "Towards Real-Time Implementation of Bayesian Parameter Estimation." In *Proceedings of the 4th IFAC Symposium on Adaptive Systems in Control and Signal Processing*, Grenoble, France, 1-3 July 1992. *IFAC Proceedings Volumes* 25 (14): 35-40.
- Böhm, Josef, and Rudolf Kulhavý. 1991. "Towards More Credible Self-Tuners ..." In *Advanced Methods in Adaptive Control for Industrial Applications*, edited by Kevin Warwick, Miroslav Kárný, and Alena Halousková, 189-205. Berlin: Springer.
- Kliokys, Edvardas, and Rudolf Kulhavý. 1990. "Bayesian Filtering for Discrete-Time Systems with Random Structure." In *Proceedings of the 3rd IFAC Symposium on Adaptive Systems in Control and Signal Processing*, Glasgow, UK, 19-21 April 1989. *IFAC Proceedings Volumes* 23 (1): 483-487.
- Kulhavý, Rudolf. 1990. "Differential Geometry of Recursive Nonlinear Estimation." In *Proceedings of the 11th IFAC World Congress*, Tallinn, Estonia, 13-17 August 1990. *IFAC Proceedings Volumes* 23 (8.2): 83-88.
- Böhm, Josef, Miroslav Kárný, and Rudolf Kulhavý. 1989. "Practically-Oriented LQ Self-Tuners." In *Proceedings of the IFAC Workshop on Evaluation of Adaptive Control Strategies in Industrial Applications*, Tbilisi, USSR, 17-20 October 1989. *IFAC Proceedings Volumes* 22 (16): 75-80.
- Kulhavý, Rudolf. 1986. "Directional Tracking of Regression-Type Model Parameters." In *Proceedings of the 2nd IFAC Workshop on Adaptive Systems in Control and Signal Processing*, Lund, Sweden, 30 June-2 July 1986. *IFAC Proceedings Volumes* 20 (2): 191-196.
- Kulhavý, Rudolf, and Miroslav Kárný. 1984. "Tracking of Slowly Varying Parameters by Directional Forgetting." In *Proceedings of the 9th IFAC World Congress*, Budapest, Hungary, 2-6 July 1984. *IFAC Proceedings Volumes* 17 (2): 687-692.

NUMBER OF CITATIONS

Google Scholar 1,134 citations

ResearchGate 1,057 citations

Scopus Review 413 citations

RECENTLY SUPERVISED STUDENTS

10/2018–9/2020 Yevgeniy Nazarenko, *Real Options Valuation: The Binomial Model*, BSc thesis
Faculty of Nuclear Sciences and Physical Engineering
Czech Technical University, Prague, Czech Republic

10/2019–5/2021 Filip Rolenc, *Real Options Valuation: A Dynamic Programming Approach*, MSc thesis
Faculty of Nuclear Sciences and Physical Engineering
Czech Technical University, Prague, Czech Republic

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