Kai Virtanen
CURRICULUM VITAE

Personal information:
Name: Virtanen, Kai Matti Olavi
Birth date: February 23, 1970
Birth place: Hyvinkää, Finland
Citizenship: Finnish

Addresses:
Office: Aalto University
                     School of Science
                     Department of Mathematics and Systems Analysis
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Education:
· *Doctor of Technology*, Helsinki University of Technology, Department of Engineering Physics and
  Mathematics, August 23, 2005, Accepted with distinction
  Major: Systems and Operations Research
  Minor: Mathematics
  Thesis title: Optimal Pilot Decisions and Flight Trajectories in Air Combat
· *Master of Science*, Helsinki University of Technology, Department of Information Science, January
  30, 1996, Accepted with distinction
  Major: Systems and Operations Research
  Minor: Energy Economics
  Thesis title: Visual Interactive Aircraft Trajectory Optimization

Academic career:
· November 2013 – Present: *Professor of Practice*, Aalto University, School of Science,
  Department
  of Mathematics and Systems Analysis, Espoo, Finland
· August 2011 – Present: *Adjunct Professor*, National Defence University, Department of Warfare,
  Helsinki, Finland
· January 2010 – Present: *Docent*, Aalto University, School of Science,
  Department of Mathematics and Systems Analysis, Espoo, Finland
· January 2012 – October 2013: *University Lecturer*, Aalto University, School of Science,
  Department of Mathematics and Systems Analysis, Espoo, Finland
· January 2010 – December 2011: *Teaching Research Scientist*, Aalto University, School of Science,
  Department of Mathematics and Systems Analysis, Espoo, Finland
· January 2007 – December 2009: *Teaching Research Scientist*, Helsinki University of Technology,
  Systems Analysis Laboratory, Espoo, Finland
· April 1996 – December 2006: *Research Scientist*, Helsinki University of Technology,
  Systems Analysis Laboratory, Espoo, Finland
· September 2001 – February 2002: *Visiting Researcher*, University of South Australia,
  School of Mathematics, Adelaide, Australia
· June 1995 – March 1996: *Research Assistant*, Helsinki University of Technology,
  Systems Analysis Laboratory, Espoo, Finland
· September 1994 – May 1995: *Teaching Assistant*, Helsinki University of Technology,
  Systems Analysis Laboratory, Espoo, Finland

- June 1994 – August 1994: *Research Assistant*, Helsinki University of Technology, Systems Analysis Laboratory, Espoo, Finland

- *Project Manager* in the following research projects,
  Aalto University or Helsinki University of Technology, Systems Analysis Laboratory:
    - 2017 – 2020: Finnish Air Force, *Improving Tactical Use of Aircraft Fleet 3*
    - 2013 – 2016: Finnish Air Force, *Improving Tactical Use of Aircraft Fleet 2*
    - 2014 – 2015: Finnish Air Force, *Modeling of Anti-Aircraft Defense Capability against Projectiles*
    - 2014 – 2015: Finnish Air Force, *Simulation-Optimization of Maintenance Systems*
    - 2010 – 2012: Finnish Air Force, *Improving Tactical Use of Aircraft Fleet*
    - 2010: Finnish Air Force, *Optimization of Flight Routes and Base Locations*
    - 2010: Finnish Defence Forces, *Center of Gravity Analysis using Bayesian Networks*
    - 2007 – 2009: Finnish Air Force, *Modeling of Air Operations*
    - 2000 – 2007: Finnish Air Force, *Dynamics and Strategy of Flight*
    - 2000 – 2007: Finnish Air Force, *Analysis of Maintenance Systems under Uncertain Operating Conditions*
    - 1999 – 2001: Patria Finavitec Ltd, *Target Selection Algorithms*

Research interests:
- Discrete event simulation including simulation-optimization and simulation metamodeling
- Dynamic optimization and games
- Human performance in complex systems
- Military operations research including combat modeling and simulation
- Multicriteria and spatial decision analysis including Bayesian networks and influence diagrams

Language skills:
Finnish (Native), English (Good), Swedish (Moderate)

Military service:
1990-1991: Finnish Defence Forces; Rank: Senior Lieutenant

Professional activities:
- Reviewer for
    - Annals of Operations Research
    - Environmental Modeling and Assessment
    - Group Decision and Negotiation
    - IEEE Transactions on Aerospace and Electronic Systems
    - IEEE Transactions on Automatic Control
    - IEEE Transactions on Systems, Man, and Cybernetics
    - Journal of Guidance, Control, and Dynamics
    - Journal of Military Studies
    - Journal of Operational Research Society
    - Journal of Optimization Theory and Applications
    - Operations Research
    - OR Spectrum
- Reviewer of research projects for *Israel Science Foundation* (ISF)
- Member of international programme committee: ASTEC, *Asian Simulation Technology Conference*, 2010 – 2015
- Chairman of *the Systems Analysis Section of the Scientific Advisory Board for Defence* (MATINE), 2016 – Present, Member 2013 – 2015
- Member of
    - *Finnish Operations Research Society* (FORS)
    - *International Society of Dynamic Games* (ISDG)
    - *International Society on Multiple Criteria Decision Making*
- Supervisor: *Finnish Doctoral Education Network in Systems Analysis, Decision Making and Risk Management*, 2005 – Present
- Representative of the Systems Analysis Laboratory research group, Aalto University, at *the Consortium of Finnish Virtual University Network for Teaching Mathematical Modeling*, 2002 – 2015

- Deputy member of *the degree programme committee*, School of Science, Aalto University, 2015 - Present

Decorations, awards and grants:
- The Operations Researcher of the Year 2015 nominated by the Board of Finnish Operations Research Society
- Medal for Military Merits, 2013
- Systems Analysis Laboratory Research Group, Department of Mathematics and Systems Analysis, School of Science, Aalto University; Teacher of the Year 2011
- Systems Analysis Laboratory, Helsinki University of Technology; Teacher of the Year 2007 and 2008
- Helsinki University of Technology; Award for PhD, 2005
- Emil Aaltonen Foundation, 2000
- Finnish Foundation for Technology Promotion, 1999
- Wihuri Foundation, 1997

Teaching experience:
- Courses lectured (all in Aalto University or Helsinki University of Technology)
  - "*Simulation,*" 2016
  - "*Methods of Physics and Mathematics Studio,*" 2015-2017
  - "*System Identification,*" 2007-2016
  - "*Introduction to Statistical Analysis,*" 2006-2014
  - "*Systems Analysis Laboratory I*: Selected topics on System Dynamics, Systems Thinking, and Time Series Analysis," 2003-2017
  - "*Systems Analysis Laboratory II*: Selected topics on Control Theory and Dynamic Optimization," 2003-2016
  - "*Dynamic Optimization,*" 2000-2003
- Seminars organized (all in Helsinki University of Technology)
  - "*Seminar on Optimization*: Bayesian Networks and Influence Diagrams," 2005; http://salserver.org.aalto.fi/vanhat_sivut/Opinnot/Mat-2.4142/S2005
  - "*Seminar on Optimization*: Influence Diagrams and Belief Networks," 1999; http://salserver.org.aalto.fi/vanhat_sivut/Opinnot/Mat-2.4142/Sem_syksy99/
- Supervision of web-based courses (all in Aalto University or Helsinki University of Technology)
  - "*Mathematical Modelling*," 2000-2016
  - "*Web-based Courses in Systems Analysis*," 2005-2006, 2014-2016
  - "*Multicriteria Optimization*," 2000-2001
- Teaching assistant (all in Helsinki University of Technology)
  - "*System Identification*," 2005
  - "*Systems Research Seminar*," 2000-2001
  - "*Dynamic Optimization*," 1997-1999
  - "*Seminar on Optimization*: Fuzzy Mathematical Models," 1997
  - "*Graduate Seminar on Applied Mathematics*: Stochastic Dynamic Optimization," 1996
  - "*Mathematical Modelling*," 1995
  - "*Applied Probability*," 1994
- Visiting lectures
  - "*Multicriteria Evaluation of Course of Actions,*" National Defence University, Finland, 2010-2017
  - "*Supporting Decision Making with Modeling and Simulation in Finnish Air Force,*" National Defence University, Finland, 2013-2016

Supervision of theses:
- Doctoral (in Aalto University or Helsinki University of Technology)
  - Jirka Poropudas, 2011, awarded the "*Doctoral Dissertation of the Year in the Doctoral Programme in Science*" prize of 2011, School of Science, Aalto University; Janne Karelahti, 2008; ongoing: Ville Mattila, Pekka Laitila, Heikki Puustinen, Mikko Harju
- Four Senior staff officer course theses (in National Defence University)
- Ten Staff officer course theses (in National Defence University)
- Master (in Aalto University or Helsinki University of Technology)

- o Riku Hyytiäinen, 2017; Pekka Laitila, 2013; Heikki Puustinen, 2013; Mikko Harju, 2013; Juho Kokkala, 2010; Jouni Pousi, 2009; Jaakko Sotkasiira, 2006; Jirka Poropudas, 2005; Tiia Järvenpää, 2003; Ville Mattila, 2002; ongoing: Eero Rantala
- · Approximately 60 Bachelor theses and Special assignments (in Aalto University or Helsinki University of Technology)

Conference presentations:
- · 4th Nordic Military Analysis Seminar, Helsinki, Finland, June 1-2, 2015, "*On Modeling, Simulation and Optimization of Military Air Operations*"
- · Winter Simulation Conference 2014, Savannah, GA, USA, December 7-10, 2014, "*Optimizing Locations of Decoys for Protecting Surface-based Radar against Anti-Radiation Missile with Multi-Objective Ranking and Selection*"
- · 25th European Conference on Operational Research, Vilnius, Lithuania, July 8-11, 2012, "*Simulation Metamodeling using Bayesian Networks*"
- · 21st International Conference on Multiple Criteria Decision Making, Jyväskylä, Finland, June 12-17, 2011 "*Utilization of Multi-Criteria Influence Diagrams in Simulation Metamodeling*"
- · 20th International Conference on Multiple Criteria Decision Making, Chengdu, China, June 21-26, 2009, "*Maintenance Scheduling of Fighter Aircraft Fleet with Multi-Objective Simulation-Optimization*"
- · 20th International Conference on Multiple Criteria Decision Making, Chengdu, China, June 21-26, 2009, "*Multiple Criteria Optimization and Analysis in the Planning of Effects-Based Operations (EBO)*"
- · INFORMS Annual Meeting 2008, Washington, DC, USA, October 12-15, 2008, "*Game Theoretic Approach to Air Combat Simulation*"
- · 2nd Nordic Military Analysis Symposium, Stockholm, Sweden, November 17-18, 2008, "*Games and Bayesian Networks in Air Combat Simulation Analysis*"
- · Winter Simulation Conference 2007, Washington, DC, USA, December 9-12, 2007, "*Flight Time Allocation for a Fleet of Aircraft through Reinforcement Learning*" (poster presentation)
- · 46th IEEE Conference on Decision and Control, New Orleans, Louisiana, USA, December 12-14, 2007, "*Identifying the Guidance Law of an Air-to-Air Missile using Bayesian Reasoning*" (poster presentation)
- · INFORMS International, Hong Kong, China, June 25-28, 2006, "*A Multistage Influence Diagram Game for Maneuvering Decisions in Air Combat*"
- · European Simulation and Modelling Conference 2005, Porto, Portugal, October 24-26, 2005, "*Simulating Pilot's Decision Making by an Influence Diagram Game*"
- · 11th International Symposium on Differential Games and Applications, December 18-21, 2004, Tucson, Arizona, USA, "*Multistage Influence Diagram Game for Maneuvering Decisions in Air Combat*"
- · 1st Nordic Military Operational Research Symposium, Helsinki, Finland, October 26-27, 2004, "*Influence Diagram Game Modeling of Maneuvering Decisions in One-on-One Air Combat*"
- · 1st Nordic Military Operational Research Symposium, Helsinki, Finland, October 26-27, 2004, "*Optimal Pilot Decisions and Flight Trajectories in Air Combat*"
- · Finnish Operations Research Society - 30th Anniversary Conference, Helsinki, Finland, November 13, 2003, "*Optimal Maneuvering and Flight Trajectories in Air Combat*" (in Finnish)
- · 1st Bayesian Modeling Applications Workshop of the 19th Conference on Uncertainty in Artificial Intelligence, Acapulco, Mexico, August 7, 2003, "*Influence Diagram Modeling of Decision Making in a Dynamic Game Setting*"
- · 10th International Symposium on Differential Games and Applications, St. Petersburg, Russia, July 8-11, 2002, "*An Influence Diagram Approach to One-on-One Air Combat*"
- · AIAA Guidance, Control, and Navigation Conference, Montreal, Canada, August 6-9, 2001, "*Modeling Pilot's Sequential Maneuvering Decisions by a Multistage Influence Diagram*"
- · 9th International Symposium on Differential Games and Applications, Adelaide, Australia, December 18-21, 2000, "*Team Optimal Signaling Strategies in Air Combat*"
- · 4th Noon2nooN Seminar on Decision Sciences and Applications, Helsinki, Finland, December 16-17, 1998, "*Modeling Pilot Decision Making by an Influence Diagram*"
- · AIAA Modeling and Simulation Technologies Conference, Boston, MA, USA, August 10-12, 1998, "*Modeling Pilot Decision Making by an Influence Diagram*"

- EUROSIM'98 Simulation Congress, Espoo, Finland, April 14-15, 1998, "*A Decision Analytic Approach to Flight Simulation*"
- IEEE International Conference on Systems, Man, and Cybernetics, Orlando, Florida, USA, October 12-15, 1997, "*VIATO - Visual Interactive Aircraft Trajectory Optimization*"
- 10th European Simulation Multiconference, Budapest, Hungary, June 2-6, 1996, "*Interactive Aircraft Trajectory Optimization and Simulation*"

List of publications and software
Kai Virtanen

Articles in refereed journals:

1. Mansikka H., Harris D., and Virtanen K.: **An Input-Process-Output Model of Pilot Core Competencies.** Accepted for publication in Aviation Psychology and Applied Human Factors.
2. Kesäniemi M, and Virtanen K.: **Direct Least Square Fitting of Hyperellipsoids.** IEEE Transactions on Pattern Analysis and Machine Intelligence. January 2017. DOI: 10.1109/TPAMI.2017.2658574.
3. Mansikka H., Simola P., Virtanen K., Harris D., and Oksama L.: **Fighter Pilots' Heart Rate, Heart Rate Variation and Performance during Instrument Approaches.** Ergonomics, Vol. 59, Issue 10, October 2016, pp. 1344-1352.
4. Laitila P., and Virtanen K.: **Improving Construction of Conditional Probability Tables for Ranked Nodes in Bayesian Networks.** IEEE Transactions on Knowledge and Data Engineering, Vol. 28, Issue 7, July 2016, pp. 1691-1705.
5. Mansikka H., Virtanen K., Harris D., and Simola P.: **Fighter Pilots' Heart Rate, Heart Rate Variation and Performance during an Instrument Flight Rules Proficiency Test.** Applied Ergonomics, Vol. 56, September 2016, pp. 213-219.
6. Mattila V., and Virtanen K.: **Ranking and Selection for Multiple Performance Measures using Incomplete Preference Information.** European Journal of Operational Research, Vol. 242, Issue 2, April 2015, pp. 568-579.
7. Mattila V., and Virtanen K.: **Maintenance Scheduling of a Fleet of Fighter Aircraft through Multi-Objective Simulation-Optimization.** SIMULATION: Transactions of The Society for Modeling and Simulation International, Vol. 90, No. 9, September 2014, pp. 1023-1040.
8. Mattila V., Virtanen K., and Hämäläinen R.P.: **A Simulated Annealing Algorithm for Noisy Multiobjective Optimization.** Journal of Multi-Criteria Decision Analysis, Vol. 20, Issue 5-6, September-December 2013, pp. 255-276.
9. Pousi J., Poropudas J., and Virtanen K.: **Simulation Metamodelling with Bayesian Networks.** Journal of Simulation, Vol. 7, Issue 4, November 2013, pp. 297-311.
10. Poropudas J., and Virtanen K.: **Simulation Metamodeling with Dynamic Bayesian Networks.** European Journal of Operational Research, Vol. 214, Issue 3, November 2011, pp. 644-655.
11. Poropudas J., and Virtanen K.: **Game Theoretic Validation and Analysis of Air Combat Simulation Models.** IEEE Transaction on Systems, Man, and Cybernetics - Part A: Systems and Humans, Vol. 40, No. 5, September 2010, pp. 1057-1070.
12. Mattila V., Virtanen K., and Raivio T.: **Improving Maintenance Decision-Making in the Finnish Air Force through Simulation.** Interfaces, Vol. 38, No. 3, May-June 2008, pp. 187-201.
13. Karelahti J., Virtanen K., and Öström J.: **Automated Generation of Realistic Near-Optimal Aircraft Trajectories.** Journal of Guidance, Control, and Dynamics, Vol. 31, No. 3, May-June 2008, pp. 674-688.
14. Karelahti J., Virtanen K., and Raivio T.: **Near-Optimal Missile Avoidance Trajectories via Receding Horizon Control.** Journal of Guidance, Control, and Dynamics, Vol. 30, No. 5, September-October 2007, pp. 1287-1298.
15. Virtanen K., Karelahti J., and Raivio T.: **Modeling Air Combat by a Moving Horizon Influence Diagram Game.** Journal of Guidance, Control, and Dynamics, Vol. 29, No. 5, September-October 2006, pp. 1080-1091.
16. Karelahti J., Virtanen K., and Raivio T.: **Game Optimal Support Time of a Medium Range Air-to-Air Missile.** Journal of Guidance, Control, and Dynamics, Vol. 29, No. 5, September-October 2006, pp. 1061-1069.
17. Virtanen K., Hämäläinen R.P., and Mattila V.: **Team Optimal Signaling Strategies in Air Combat.** IEEE Transaction on Systems, Man, and Cybernetics - Part A: Systems and Humans, Vol. 36, No. 4, July 2006, pp. 643-660.

18. Virtanen K., Raivio T., and Hämäläinen R.P.: **Modeling Pilot's Sequential Maneuvering Decisions by a Multistage Influence Diagram.** Journal of Guidance, Control, and Dynamics, Vol. 27, No. 4, July-August 2004, pp. 665-677.
19. Virtanen K., Raivio T., and Hämäläinen R.P.: **Decision Theoretical Approach to Pilot Simulation.** Journal of Aircraft, Vol. 36, No. 4, July-August 1999, pp. 632-641.
20. Virtanen K., Ehtamo H., Raivio T., and Hämäläinen R.P.: **VIATO - Visual Interactive Aircraft Trajectory Optimization.** IEEE Transactions on Systems, Man, and Cybernetics - Part C: Applications and Reviews, Vol. 29, No. 3, August 1999, pp. 409-421.

Articles in conference proceedings:

21. Jylhä J., Ruotsalainen M., Väisänen V., Virtanen K., Harju M., and Väilä M.: **A Machine Learning Framework for Performance Prediction of an Air Surveillance System.** Proceedings of the 14th European Radar Conference (EuRAD), October 11-13, 2017, Nuremberg, Germany.
22. Väilä M., Jylhä J., Väisänen V., Perälä H., Visa A., Harju M., and Virtanen K.: **A RCS Model of Complex Targets for Radar Performance Prediction.** Proceedings of the 2017 IEEE Radar Conference, May 8-12, 2017, Seattle, WA, USA.
23. Mansikka H., Harris D., and Virtanen K.: **Relationship between Situation Awareness and other Core Competencies: A Case Study of Pilot Proficiency Checks.** Proceedings of the 32nd European Association for Aviation Psychology (EAAP) Conference, September 26-30, 2016, Cascais, Portugal.
24. Harju M., Virtanen K., and Poropudas J.: **Simulation Metamodeling using Dynamic Bayesian Networks with Multiple Time Scales.** Proceedings of the 9th EUROSIM Congress on Modelling and Simulation, September 12-16, 2016, Oulu, Finland, pp. 572-578.
25. Mattila V., Muttilainen L., Virtanen K., Jylhä J., and Väisänen V.: **Optimizing Locations of Decoys for Protecting Surface-based Radar against Anti-Radiation Missile with Multi-Objective Ranking and Selection.** Proceedings of the Winter Simulation Conference 2014, December 7-10, 2014, Savannah, Georgia, USA, pp. 2319-2330.
26. Poropudas J., Pousi J., and Virtanen K.: **Multiple Input and Multiple Output Simulation Metamodeling using Bayesian Networks.** Proceedings of the Winter Simulation Conference 2011, December 11-14, 2011, Phoenix, Arizona, USA, pp. 569-580.
27. Mattila V., and Virtanen K.: **Scheduling Fighter Maintenance with Reinforcement Learning.** Proceedings of the Winter Simulation Conference 2011, December 11-14, 2011, Phoenix, Arizona, USA, pp. 2535-2546.
28. Poropudas J., and Virtanen K.: **Simulation Metamodeling in Continuous Time using Dynamic Bayesian Networks.** Proceedings of the Winter Simulation Conference 2010, December 3-5, 2010, Baltimore, MD, USA, pp. 935-946.
29. Pousi J., Poropudas J., and Virtanen K.: **Game Theoretic Simulation Metamodeling using Stochastic Kriging.** Proceedings of the Winter Simulation Conference 2010, December 3-5, 2010, Baltimore, MD, USA, pp. 1456-1467.
30. Poropudas J., and Virtanen K.: **Influence Diagrams in Analysis of Discrete Event Simulation Data.** Proceedings of the Winter Simulation Conference 2009, December 13-16, 2009, Austin, Texas, USA, pp. 696-708.
31. Poropudas J., and Virtanen K.: **Game Theoretic Validation of Air Combat Simulation Models.** Proceedings of the 2009 IEEE International Conference on Systems, Man, and Cybernetics, October 11-14, 2009, San Antonio, Texas, USA, pp. 3243-3250.
32. Karelahti J., and Virtanen K.: **Identifying the Guidance Law of an Air-to-Air Missile using Bayesian Reasoning.** Proceedings of the 46th IEEE Conference on Decision and Control, December 12-14, 2007, New Orleans, Louisiana, USA, pp. 1306-1313.
33. Karelahti J., Virtanen K., and Öström J.**: Automated Solution of Realistic Near-Optimal Aircraft Trajectories using Computational Optimal Control and Inverse Simulation.** Proceedings of the AIAA Guidance, Navigation, and Control Conference, August 20-23, 2007, Hilton Head, South Carolina, USA, CD.
34. Poropudas J., and Virtanen K.: **Analyzing Air Combat Simulation Results with Dynamic Bayesian Networks.** Proceedings of the Winter Simulation Conference 2007, December 9-12, 2007, Washington, DC, USA, pp. 1370-1377.
35. Mattila V., and Virtanen K.: **Scheduling Periodic Maintenance of Aircraft through Simulation-based Optimization.** Proceedings of the 47th Conference on Simulation and

Modelling, SIMS2006, Helsinki, Finland, September 27-29, 2006, Helsinki, Finland, pp. 38-43.

36. Poropudas J., and Virtanen K.: **Game Theoretic Analysis of an Air Combat Simulation Model.** Proceedings of the 12th International Symposium on Dynamic Games and Applications, July 21-24, 2006, Sophia Antipolis, French, CD.

37. Karelahti J., Virtanen K., and Raivio T.: **Near-Optimal Missile Avoidance Trajectories via Receding Horizon Control.** Proceedings of the AIAA Guidance, Navigation, and Control Conference, August 21-24, 2006, Keystone, Colorado, USA, CD.

38. Mattila V., and Virtanen K.: **A Simulation-based Optimization Model to Schedule Periodic Maintenance of a Fleet of Aircraft.** Proceedings of the 2005 European Simulation and Modelling Conference, October 24-26, 2005, Porto, Portugal, pp. 479-483.

39. Virtanen K., Raivio T., and Hämäläinen R.P.: **Simulating Pilot's Decision Making by an Influence Diagram Game.** Proceedings of the 2005 European Simulation and Modelling Conference, October 24-26, 2005, Porto, Portugal, pp. 87-91.

40. Karelahti J., Virtanen K., and Raivio T.: **Game Optimal Support Time of a Medium Range Air-to-Air Missile.** Proceedings of the 11th International Symposium on Differential Games and Applications, December 18-21, 2004, Tucson, Arizona, USA, CD.

41. Virtanen K., Karelahti J., Raivio T., and Hämäläinen R.P.: **A Multistage Influence Diagram Game for Maneuvering Decisions in Air Combat.** Proceedings of the 11th International Symposium on Differential Games and Applications, December 18-21, 2004, Tucson, Arizona, USA, CD.

42. Virtanen, K., Karelahti J., Raivio T., and Hämäläinen R.P.: **Influence Diagram Game Modeling of Maneuvering Decisions in One-on-One Air Combat.** Proceedings of the 1st Nordic Military Operational Research Symposium, October 26-27, 2004, Helsinki Finland, CD.

43. Virtanen K., Raivio T., and Hämäläinen R.P.: **Influence Diagram Modeling of Decision Making in a Dynamic Game Setting.** Proceedings of the 1st Bayesian Modeling Applications Workshop of the 19th Conference on Uncertainty in Artificial Intelligence (UAI-03), August 7, 2003, Acapulco, Mexico, pp. 1-16.

44. Mattila V., Virtanen K., and Raivio T.: **A Simulation Model for Aircraft Maintenance in an Uncertain Operational Environment.** Proceedings of the 17th European Simulation Multiconference, June 9-11, 2003, Nottingham, England, pp. 456-461.

45. Virtanen K., Raivio T., and Hämäläinen R.P.: **An Influence Diagram Approach to One-on-One Air Combat.** Proceedings of the 10th International Symposium on Differential Games and Applications, July 8-11, 2002, St. Petersburg, Russia, pp. 859-864.

46. Virtanen K., Raivio T., and Hämäläinen R.P.: **Modeling Pilot's Sequential Maneuvering Decisions by a Multistage Influence Diagram.** Proceedings of the AIAA Guidance, Control, and Navigation Conference, August 6-9, 2001, Montreal, Canada, CD.

47. Virtanen K., Hämäläinen R.P., and Mattila V.: **Team Optimal Signaling Strategies in Air Combat.** Proceedings of the 2001 IEEE Systems, Man, and Cybernetics Conference, October 7-10, 2001, Tucson, Arizona, USA, pp. 2075-2080.

48. Raivio T., Kuumola E., Mattila V.A., Virtanen K., and Hämäläinen R.P.: **A Simulation Model for Military Aircraft Maintenance and Availability.** Proceedings of the 15th European Simulation Multiconference, ESM2001, June 6-9, 2001, Prague, Czech, pp. 190-194.

49. Kesäniemi M.I., Korvenoja A., Lötjönen J., Virtanen K., Ollikainen M., and Ilmoniemi R.J.: **Algorithm for Automatic Nonlinear Inter-Subject Registration.** Proceedings of the 12th International Conference on Biomagnetism, Biomag2000, August 13-16, 2000, Espoo, Finland, pp. 805-808.

50. Raivio T., Virtanen K., Ehtamo H., and Hämäläinen R.P.: **Microcomputer Simulation of Optimal Flight Paths.** Proceedings of the EUROSIM'98 Simulation Congress, Vol. 2, April 14-15, 1998, Espoo, Finland, pp. 288-289.

51. Virtanen K., Raivio T., and Hämäläinen R.P.: **Modeling Pilot Decision Making by an Influence Diagram.** Proceedings of the AIAA Modeling and Simulation Technologies Conference, Boston, MA, USA, August 10-12, 1998, pp. 447-457.

52. Virtanen K., Raivio T., and Hämäläinen R.P.: **A Decision Analytic Approach to Flight Simulation.** Proceedings of the EUROSIM'98 Simulation Congress, Vol. 2, April 14-15, 1998, Espoo, Finland, pp. 292-293.

53. Virtanen K., Ehtamo H., Raivio T., and Hämäläinen R.P.: **VIATO - Visual Interactive Aircraft Trajectory Optimization.** Proceedings of the 1997 IEEE International Conference

on Systems, Man, and Cybernetics, Vol. 3, October 12-15, 1997, Orlando, Florida, USA, pp. 2280-2285.

54. Ehtamo H., and Virtanen K.: **Interactive Aircraft Trajectory Optimization and Simulation.** Proceedings of the 10th European Simulation Multiconference, ESM1996, June 7-10, 1996, Budapest, Hungary, pp. 150-154.

Other publications:

55. Kokkala J., Virtanen K., Poropudas J.: **Rationalizable Strategies in Games With Incomplete Preferences.** MPRA Paper 68331, December 2015.
56. Mansikka H., Simola P., Virtanen K., and Oksama L.: **Fighter Pilots' Heart Rate Variation and Performance during Instrument Approaches - A Feasibility Study.** Finnish Defence Research Agency, Concepts and Doctrine Division, Research Report, ID 14.17.1, December 2014.
57. Virtanen K.: **Optimal Pilot Decisions and Flight Trajectories in Air Combat.** Doctoral Dissertation, Helsinki University of Technology, Systems Analysis Laboratory, Research Reports A90, March 2005.
58. Virtanen K.: **Optimal Maneuvering and Flight Trajectories in Air Combat.** Finnish Operations Research Society 1973-2003 - 30th Anniversary Book, Finnish Operations Research Society, Helsinki, Finland, 2003, pp. 45-46. (in Finnish)
59. Virtanen K.**: Utilizing Operations Research in Analysis of Electricity Markets.** Member Bulletin of Finnish Operations Research Society, Vol. 3, 1998, pp. 10-12. (in Finnish)
60. Virtanen K., Raivio T., Ehtamo H., and Hämäläinen R.P.: **Decision Making Models of Flight Simulators.** Finnish Scientific Advisory Board for Defense (MATINE), Report Series A, 1998/2, Helsinki, Finland 1998. (in Finnish)
61. Virtanen K.: **Belief Networks and Influence Diagrams.** R.P. Hämäläinen (ed.): Novel Approaches to Decision Support in Multicriteria Water Resources Planning. Helsinki University of Technology, Systems Analysis Laboratory, Research Reports B21, May 1997, pp. 79-84. (in Finnish)
62. Virtanen K.: **Visual Interactive Aircraft Trajectory Optimization.** Master thesis, Helsinki University of Technology, Systems Analysis Laboratory, January 1996. (in Finnish)
63. Virtanen K.: **New Trends in Finnish Energy Sector - Nordic Electricity Markets.** Helsinki University of Technology, Laboratory of Energy Economics and Power Plant Engineering, Report 72, 1995, pp. 30-51. (in Finnish)

Manuscripts:

64. Puustinen H., Virtanen K., Sailaranta T., and Mansikka H.: **Military Aircraft Routing with Multi-Objective Network Optimization and Simulation.**
65. Laitila P., and Virtanen K.: **Empirical Study on Performance of Ranked Nodes Method in Probability Elicitation of Bayesian Networks.**
66. Harju M., Liesiö J., and Virtanen K.: **Preference Programming for Spatial Multiattribute Decision Analysis with Incomplete Preference Information.**
67. Virtanen K., and Rantala E.: **Allocation and Scheduling of Aircraft to Air Surveillance Missions through Simulation.**
68. Virtanen K., Harju M., Jylhä J., Väisänen V., and Pousi J.: **Performance Assessment of Air Surveillance Network by Combining Radar, Tracker and Operator Models.**

Software design:

69. **MOFRO** – Multi-Objective Flight Route Optimization utilizing multi-objective network optimization and simulation, developed jointly with Heikki Puustinen, 2016.
70. **VIAFU** – Visual Interactive Allocation and scheduling of Flight Units to air surveillance missions utilizing heuristics and simulation, developed jointly with Eero Rantala, 2016.
71. **PEIBI** – Probability Elicitation Interface for Bayesian networks Including ranked nodes, developed jointly with Pekka Laitila, 2014.
72. **Ebolator** – Interactive decision support tool for the planning of effects-based operations utilizing multi-criteria influence diagrams, developed jointly with Jouni Pousi, 2009.

73. **Ace** – Interactive decision support tool for the automated generation of realistic near-optimal aircraft trajectories utilizing computational optimal control and inverse simulation, developed jointly with Janne Karelahti, 2007.
74. **MATO** – Missile Avoidance Trajectory Optimization, developed jointly with Tiia Järvenpää, 2003.
75. **IPAC** – Information Prioritization in Air Combat, developed jointly with Ville Mattila, 2001.
76. **VIATO** – Visual Interactive Aircraft Trajectory Optimization, 1996.