

List of publications

Kai Virtanen

Articles in refereed journals:

1. Laitila P., and Virtanen K.: **Portraying Probabilistic Relationships of Continuous Nodes in Bayesian Networks with Ranked Nodes Method**. Decision Support Systems, Accepted for publication.
2. Virtanen K., Mansikka H., Kontio H., and Harris D.: **Weight Watchers: NASA-TLX Weights Revisited**. Theoretical Issues in Ergonomics Science, Accepted for publication, DOI: 10.1080/1463922X.2021.2000667.
3. Mansikka H., Virtanen K., Harris D., and Mäkinen L.: **Measurement of Normative Performance in Simulated Air Combat**. Aerospace Medicine and Human Performance, Vol. 92, No. 11, November 2021, pp. 908-912.
4. Harris D., Mansikka H., and Virtanen K.: **The Relationship between The Dynamic Model of Crew Resource Management and Line Operational Safety Audits**. International Journal of Human Factors and Ergonomics, Vol. 8, No. 4, 2021, pp. 319-330.
5. Mansikka H., Virtanen K., Uggeldahl V., and Harris D.: **Team Situation Awareness Accuracy Measurement Technique for Simulated Air Combat – Curvilinear Relationship between Awareness and Performance**. Applied Ergonomics, Vol. 96, October 2021, 103473.
6. Mansikka H., Virtanen K., Harris D., and Salomäki J.: **Live-Virtual-Constructive Simulation for Testing and Evaluation of Air Combat Tactics, Techniques, and Procedures, Part 1: Assessment Framework**. Journal of Defense Modeling and Simulation, Vol. 18, Issue 4, October 2021, pp. 285-293.
7. Mansikka H., Virtanen K., Harris D., and Salomäki J.: **Live-Virtual-Constructive Simulation for Testing and Evaluation of Air Combat Tactics, Techniques, and Procedures, Part 2: Demonstration of the Framework**. Journal of Defense Modeling and Simulation, Vol. 18, Issue 4, October 2021, pp. 295-308.
8. Öhman M., Hiltunen M., Virtanen K., and Holmström J.: **Frontlog Scheduling in Aircraft Line Maintenance: From Explorative Solution Design to Theoretical Insight into Buffer Management**. Journal of Operations Management, Vol. 67, Issue 2, March 2021, pp. 120-151.
9. Mansikka H., Virtanen K., Harris D., and Jalava M.: **Measurement of Team Performance in Air Combat – Have We Been Underperforming?** Theoretical Issues in Ergonomics Science, Vol. 22, Issue 3, 2021, pp. 338-359.
10. Laitila P., and Virtanen K.: **On Theoretical Principle and Practical Applicability of Ranked Nodes Method for Constructing Conditional Probability Tables of Bayesian Networks**. IEEE Transactions on Systems, Man, and Cybernetics: Systems, Vol. 50, Issue 5, May 2020, pp. 1943-1955.
11. Mansikka H., Harris D., and Virtanen K.: **Pilot Competencies as Components of a Dynamic Human-Machine System**. Human Factors and Ergonomics in Manufacturing & Service Industries, Vol. 29, Issue 6, November 2019, pp. 466-477.
12. Harju M., Liesiö J., and Virtanen K.: **Spatial Multi-Attribute Decision Analysis: Axiomatic Foundations and Incomplete Preference Information**. European Journal of Operational Research, Vol. 275, Issue 1, May 2019, pp. 167-181.
13. Kokkala J., Berg K., Virtanen K., and Poropudas J.: **Rationalizable Strategies in Games with Incomplete Preferences**. Theory and Decision, Vol. 86, Issue 2, March 2019, pp. 185-204.
14. Mansikka H., Virtanen K., and Harris D.: **Dissociation between Mental Workload, Performance, and Task Awareness in Pilots of High Performance Aircraft**. IEEE Transactions on Human-Machine Systems, Vol. 49, Issue 1, February 2019, pp. 1-9.
15. Lahti J., Saileranta T., Harju M., and Virtanen K.: **Control of Exterior Ballistic Properties of Spin-Stabilized Bullet by Optimizing Internal Mass Distribution**. Defence Technology, Vol. 15, Issue 1, February 2019, pp. 38-50.

16. Mansikka H., Virtanen K., and Harris D.: **Comparison of NASA-TLX Scale, Modified Cooper-Harper Scale and Mean Inter-Beat Interval as Measures of Pilot Mental Workload during Simulated Flight Tasks.** *Ergonomics*, Vol. 62, No. 2, February 2019, pp. 246-254.
17. Kesäniemi M., and Virtanen K.: **Direct Least Square Fitting of Hyperellipsoids.** *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 40, Issue 1, January 2018, pp. 63-76.
18. Mansikka H., Harris D., and Virtanen K.: **An Input-Process-Output Model of Pilot Core Competencies.** *Aviation Psychology and Applied Human Factors*, Vol. 7, Issue 2, September 2017, pp. 78-85.
19. 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.
20. 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.
21. 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.
22. 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.
23. 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.
24. 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.
25. Pousi J., Poropudas J., and Virtanen K.: **Simulation Metamodelling with Bayesian Networks.** *Journal of Simulation*, Vol. 7, Issue 4, November 2013, pp. 297-311.
26. 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.
27. 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.
28. 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.
29. Karelähti 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.
30. Karelähti 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.
31. Virtanen K., Karelähti 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.
32. Karelähti 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.
33. 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.
34. 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.

35. 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.
36. 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:

37. Mansikka H., Virtanen K., and Harris D.: **Retrospective Verbal Probing in Evaluation of Pilots' Situation Models in Simulated Air Combat**. Proceedings of the 34th European Association for Aviation Psychology (EAAP) Conference, September 20-24, 2021, Gibraltar, UK, pp. 73-82.
38. 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, Linköping University Electronic Press, December 2018, pp. 619-625.
39. 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, pp. 187-190.
40. 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, pp. 430-435.
41. 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, pp. 283-296.
42. Mattila V., Mutttilainen 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.
43. 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.
44. 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.
45. 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.
46. 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.
47. 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.
48. 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.
49. Karelähti 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.
50. Karelähti 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.

51. 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.
52. 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.
53. 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.
54. Karelaiti 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.
55. 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.
56. 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.
57. Karelaiti 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.
58. Virtanen K., Karelaiti 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.
59. Virtanen K., Karelaiti 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.
60. 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.
61. 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.
62. 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.
63. 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.
64. 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.
65. Raivio T., Kuumola E., Mattila V., 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.
66. 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.
67. 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.
68. 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.

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70. 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.
71. 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:

72. Hemminki P., Virtanen K., and Halunen K.: **Utilisation of Artificial Intelligence in Autonomous Weapons Systems - What Should We Prepare for?** Chapter of the book entitled "Knowledge about Military Economy, Vol VII", Finnish Military Economy Society, to appear. (in Finnish)
73. Laitila P., and Virtanen K.: **Technical Properties of Ranked Nodes Method**. arXiv Paper 2107.12747v1, July 2021.
74. Virtanen K.: **Spatial Decision Analysis in Regional Analysis and Optimisation of Military Capabilities**. Yearbook 2019 of Defence Research - 100 Years of Defence Research. The Finnish Defence Forces, ISBN 978-951-25-3070-0, ISSN 2489-7329, April 2019, pp. 88-89. (in Finnish)
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77. 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.
78. 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)
79. 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)
80. 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)
81. 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)
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83. 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)

Software design:

84. COALator - The tool for spatiotemporal evaluation of courses of action, developed jointly with Heikki Puustinen, 2020.
85. The simulation tool for analyzing effects of fragmenting ammunitions on multiple protective covers and targets, developed jointly with Patrik Lahti and Heikki Puustinen, 2020.

86. The tool for analysis, optimization and visualization of performance of an air surveillance network using machine learning and simulation, developed jointly with Mikko Harju et al., 2020.
87. The tool for planning and optimization of multi-stage surveillance, reconnaissance and target acquisition missions using multi-objective network optimization and simulation, developed jointly with Nina Gunell and Heikki Puustinen, 2020.
88. The tool for planning and optimization of air-to-surface operations using multi-objective network optimization and simulation, developed jointly with Heikki Puustinen, 2020.
89. The tool for allocation and scheduling of flight units to air missions using heuristics and simulation, developed jointly with Janne Lahti and Eero Rantala, 2019.
90. COALite - The excel spreadsheet tool for multi-criteria evaluation of courses of action, developed jointly with Pekka Laitila and Jouni Pousi, 2018.
91. The expert elicitation tool for construction of conditional probability tables of Bayesian networks using the ranked nodes method, developed jointly with Pekka Laitila, 2014.
92. EboLator - Interactive decision support tool for the planning of effects-based operations utilizing multi-criteria influence diagrams, developed jointly with Jouni Pousi, 2009.
93. 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.
94. MATO - Missile Avoidance Trajectory Optimization, developed jointly with Tiia Järvenpää, 2003.
95. IPAC - Information Prioritization in Air Combat, developed jointly with Ville Mattila, 2001.
96. VIATO - Visual Interactive Aircraft Trajectory Optimization, 1996.