

Kai Virtanen CURRICULUM VITAE

Personal information:

Name: Virtanen, Kai Matti Olavi
Birth date: February 23, 1970
Birth place: Hyvinkää, Finland
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Office: Aalto University
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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:

- July 2022 – Present: *Research Director and Adjunct Professor* in the joint professorship of Operations Research at Department of Mathematics and Systems Analysis, School of Science, Aalto University and at Department of Military Technology, National Defence University, Finland
- July 2017 – June 2022: *Professor of Practice* in the joint professorship of Operations Research at Department of Mathematics and Systems Analysis, School of Science, Aalto University and at Department of Military Technology, National Defence University, Finland
- November 2013 – June 2017: *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, Department of Mathematics and Systems Analysis:
 - 2021 – 2024: Finnish Air Force, *Improving Tactical Use of Aircraft Fleet 4*
 - 2023 – 2024: Finnish Defence Forces, *Defence Forces Research Programme: Situational Awareness and Sensor Fusion*
 - 2021 – 2023: Finnish Defence Forces, *Defence Forces Research Programme: Decision Support for Joint Operations*
 - 2021 – 2022: Ministry of Defence, *Effects of Wind Power Farms on Military Readiness*
 - 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:

- Dynamic optimization and games
- Human behavior and performance in complex systems
- Military operations research including combat modeling and simulation
- Multicriteria and spatial decision analysis including Bayesian networks and influence diagrams
- Simulation including simulation-optimization and simulation metamodeling

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
 - Ergonomics
 - EURO Journal on Decision Processes
 - European Journal of Operational Research
 - Group Decision and Negotiation
 - IEEE Transactions on Aerospace and Electronic Systems
 - IEEE Transactions on Automatic Control
 - IEEE Transactions on Knowledge and Data Engineering
 - 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
- Mathematical Problems in Engineering
- Operations Research
- OR Spectrum
- Simulation Modelling Practice and Theory
- Socio-Economic Planning Sciences
- 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*
- Representative of Aalto University and Helsinki University of Technology at *the Consortium of Finnish Virtual University Network for Teaching Mathematical Modeling*, 2002 – 2015
- Supervisor: *Finnish Doctoral Education Network in Systems Analysis, Decision Making and Risk Management*, 2005 – Present
- Deputy member of *Master's Programmes Committee of Engineering Physics, Mathematics and Operations Research*, School of Science, Aalto University, 2015 – 2022
- Member of *Research Council*, National Defence University of Finland, 2017 – Present

Decorations, awards and grants:

- The Certificate of Honor on a Distinguished Abstract in Military Days 2023 awarded by the Finnish Society of Military Sciences, 2023
- Knight, First Class, of the Order of the Lion of Finland, 2022
- Finalist for Best Paper Award Year 2021 of Journal of Operations Management, 2022
- Best Paper Award Year 2017 of Journal of Aviation Psychology and Applied Human Factors, 2017
- The Operations Researcher of the Year 2015 nominated by the Board of Finnish Operations Research Society, 2015
- 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 (Aalto University or Helsinki University of Technology)
 - “*Laboratory Assignments in Operations Research I: Selected topics on Control Theory and Dynamic Optimization*,” 2022-2024
 - “*Laboratory Assignments in Operations Research II: Selected topics on System Dynamics, Systems Thinking, and Time Series Analysis*,” 2022-2023
 - “*Computational Assignments in Applied Mathematics*,” 2021-2024
 - “*Systems Analysis Laboratory I: Selected topics on System Dynamics, Systems Thinking, and Time Series Analysis*,” 2003-2021
 - “*Systems Analysis Laboratory II: Selected topics on Control Theory and Dynamic Optimization*,” 2003-2021
 - “*Studio Course on Methods of Physics and Mathematics*,” 2015-2024
 - “*System Identification*,” 2007-2016, 2018, 2020, 2022
 - “*Simulation*,” 2016
 - “*Introduction to Statistical Analysis*,” 2006-2014
 - “*Dynamic Optimization*,” 2000-2003

- Classes and exercise sessions organized in Senior staff officer course (National Defence University)
 - *“Introduction to Operations Research and Operational Analysis,”* 2018, 2020, 2022, 2024
 - *“Supporting Decision Making with Modeling and Simulation in Finnish Air Force,”* 2018, 2020, 2022
 - *“Introduction to Multi-Criteria Decision Analysis,”* 2020, 2022
 - *“Thesis Seminar,”* 2019-2024
 - *“Research Methods in Military Studies: Modeling and Simulation,”* 2017, 2019, 2021, 2023
 - *“Research Methods in Military Studies: Value Tree Analysis and Analytic Hierarchy Process,”* 2017, 2019, 2021, 2023
 - *“Research Methods in Military Studies: Scientific Writing,”* 2021, 2023
 - *“Implementation and Facilitation of a War Game for Testing and Evaluation of Air Capabilities,”* 2019
- Classes and exercise sessions organized in Advanced course on military technology and economy (National Defence University)
 - *“Operational Analysis in Finnish Defence Forces,”* 2018-2023
 - *“Introduction to Multi-Criteria Decision Analysis including Value Tree Analysis,”* 2018-2023
 - *“Utilization of Value Tree Analysis in Development of Military Concepts and Capabilities,”* 2018-2023
 - *“Introduction to Optimization including Linear, Integer and Mixed-Integer Programming,”* 2020, 2021, 2022
 - *“Use of Modeling and Simulation in Selection of Weapons Systems,”* 2019
- Classes and exercise sessions organized in Staff officer course (National Defence University)
 - *“Multi-Criteria Evaluation of Courses of Action,”* 2018-2024
- Classes and exercise sessions organized in Master’s course in military sciences (National Defence University)
 - *“Research Methods in Military Studies: Introduction to Military Operations Research and Operational Analysis; Multi-Criteria Decision Analysis; Optimization,”* 2021-2024
 - *“Introduction to Value Tree Analysis,”* 2020-2023
 - *“Utilization of Value Tree Analysis in Planning of Military Concepts,”* 2020-2023
 - *“Advanced Course on Military Operations Research,”* 2022
 - *“Linear, Integer and Mixed-Integer Programming,”* 2019
 - *“Value Tree Analysis and Analytic Hierarchy Process,”* 2019
- Seminars organized (Helsinki University of Technology)
 - *“Seminar on Optimization: Bayesian Networks and Influence Diagrams,”* 2005
 - *“Seminar on Optimization: Influence Diagrams and Belief Networks,”* 1999
- Supervision of web-based courses (Aalto University or Helsinki University of Technology)
 - *“Mathematical Modelling,”* 2000-2024
 - *“Web-based Courses in Systems Analysis,”* 2005-2006, 2014-2020
 - *“Multicriteria Optimization,”* 2000-2001
- Teaching assistant (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
 - *“Multi-Criteria Evaluation of Course of Actions,”* National Defence University, 2010-2017
 - *“Supporting Decision Making with Modeling and Simulation in Finnish Air Force,”* National Defence University, 2013-2016

Supervision of theses:

- Doctoral theses in Aalto University or Helsinki University of Technology
 - Juha Mäntysaari, 2023; Pekka Laitila, 2022; Sampsa Ruutu, 2019; Tuomas Lahtinen, 2018; 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 Karelähti, 2008
- Five Doctoral theses ongoing in National Defence University; Pre-examination of one thesis
- Approximately 20 Senior staff officer course theses in National Defence University
- Approximately 10 Staff officer course theses in National Defence University
- Approximately 30 Master’s theses in Aalto University or Helsinki University of Technology
- Approximately 20 Master’s theses in National Defence University
- Approximately 90 Bachelor theses and Special assignments in Aalto University or Helsinki University of Technology