

CURRICULUM VITAE

Miettinen, Kaisa Marketta, ORCID id: orcid.org/0000-0003-1013-4689

Nationality: Finnish, homepage: <http://www.mit.jyu.fi/miettine/engl.html>

Education and degrees completed

- + August 24, 1994, Doctor of Philosophy (Mathematical Inform. Technology), University of Jyväskylä, Finland
- + November 16, 1988, Master of Science (Mathematics), University of Jyväskylä, Finland

Current position

September 2007 –: Professor in industrial optimization, University of Jyväskylä (JYU)

Examples of previous work experience

- + August 2012 – October 2017: Vice-rector of JYU (part-time); 2011–2012: Visiting professor in optimization and systems theory, KTH Royal Institute of Technology, Stockholm, Sweden (part-time); 2004–2007: Professor in financial mathematics, Helsinki School of Economics (HSE)

Examples of research funding

- + Tekes and 5 companies, PI, 2001–2005, 756.000 EUR
- + Tekes and 9 companies, coordinator of whole project and PI at JYU and HSE, 2005–2008, 1.149.325 EUR
- + Academy of Finland, FiDiPro project of Kalyanmoy Deb at HSE, initial PI, 2007
- + Tekes, JYU and 5 companies, PI of JYU part, 2008–2011, JYU share 212.824 EUR
- + Tekes, JYU and 2 companies, FiDiPro project of Yaochu Jin at JYU, PI, 2015–2017, 876.150 EUR
- + Academy of Finland, PI, 2009–2012, 420.000 EUR; Academy of Finland and JYU, PI, 2015–2019, 783.556 EUR; 2019–2023, 846.480 EUR

Leadership and supervision experience

- + Main supervisor of 13 post-doc researchers since 2006
- + Main supervisor of 16 and secondary supervisor of 1 doctoral theses
- + Founder and active leader of the “Multiobjective Optimization Group”, JYU, 1998–<http://www.mit.jyu.fi/optgroup>
- + Director of the profiling area at JYU: Decision Analytics Utilizing Causal Models and Multiobjective Optimization (DEMO), <http://www.jyu.fi/demo>

Some awards and honours

- + International Society on MCDM: Georg Cantor Award 2017; Presidential Service Award 2015; Conference Chairmanship Award 2011
- + Member of the Finnish Academy of Science and Letters, Section of Science, 2014–
- + Vaisala Award of the Finnish Academy of Science and Letters in mathematics for research merits, 2009

Other key scientific or academic merits

Pre-examiner or opponent of doctoral dissert. member of dissert. committees, eval. of competence

- + for 14 PhD theses

Examples of invited international keynote lectures

- + Invited plenaries: Int. Workshop on Neural Network and Genetic Algorithm in Material Science and Engineering (Howrah, 2006), MCDM2006 (Chania, 2006), EurOPT-2008 (Neringa, 2008), 11th Int. Conf. on AI and Soft Computing (Zakopane, 2012), 59th Workshop on Nonlinear Optim. (Erice, 2013), ENUMATH2015 (Ankara, 2015), Int. Conf. on OR (Hamburg, 2016), MOPTA2017 (Bethlehem, 2017), MACODA Workshop at Lorenz Center (Leiden, 2019), EUROGEN2021 (Athens, 2021)
- + Invited keynote talks: IEEE-SSCI-MCDM (Orlando, 2014), Int. Conf. on Management Sciences and Decision Making (New Taipei City, 2018), Int. Global Optim. Workshop (Leiden, 2018), 5th Int. Conf. on Machine Learning, Optim. and Data Science (Siena, 2019), IEEE World Congress on Comput. Intelligence (Glasgow, 2020)
- + Invited tutorials: 1st Int. Conf. on EMO (Zurich, 2001), 20th Int. Conf. on MCDM (Chengdu, 2009), Conf. of the Dutch OR Society (Lunteren, 2014), 10th Int. Conf. on EMO (East Lansing, 2019), 11th Int. Conf. on EMO (Shenzhen, 2021)

Merits related to open science production

- + open software framework DESDEO, <https://desdeo.it.jyu.fi/>

Memberships and positions of trust in scientific societies

- + International Society on MCDM: 2015–2019 *Immediate-Past-President*, 2011–2015 *President*, 2008–2011 *President-Elect*, 1997–2008 *Secretary*
- + EUROPT – The Continuous Optimization Working Group of EURO: 2010–2012 *President (Chair)*, 2008–2010 *General Vice-Chair*, 2006–2008 *Member of the Managing Board (and Newsletter Editor)*

Positions as member of editorial boards of scientific journals

- + In 7 journals

Scientific and societal impact of research

- + 1 C1 monograph, 115 A1 refereed journal articles, 9 A3 chapters in research books, 68 A4 conference proceedings articles, 2 B1 non-refereed journal articles, 6 B3 non-refereed proceedings articles, 17 C2 edited books or special issues + 1 in preparation, 8 D1 articles in trade journals, 74 D4 reports, 2 D5 lecture notes and 4 G theses.
- + Publications cited according to Google Scholar about 16980 times, h-index 50 and (excluding the monograph) according to Scopus 4984 times, h-index 41 (in March 2022)

The Multiobjective Optimization Group at the University of Jyväskylä

The Multiobjective Optimization Group at the University of Jyväskylä, Finland, is a part of the Faculty of Information Technology and is led by Prof. Kaisa Miettinen (since 1998). The Multiobjective Optimization Group develops theory, methodology and computer implementations for solving real-world decision-making problems. The research is inspired by the need of supporting decision making in real-world applications and focuses on (nonlinear) multiobjective optimization, that is, finding the best balance among conflicting objectives. The group is active in the thematic research area Decision Analytics utilizing Causal Models and Multiobjective Optimization (DEMO, jyu.fi/demo), which specialized in data-driven decision support. The group is also interested in developing visualizations for decision support, considering uncertainty in decision making and employing artificial intelligence, machine learning and, in particular, explainable artificial intelligence. The group develops interactive, evolutionary and hybrid methods for both simulation-based and (online and offline) data-driven problems. It develops the following types of interactive methods: classification-based methods, navigation methods, trade-off free methods and methods where different types of preference information can be provided by the decision maker. The group also actively explores new paradigms for multiobjective optimization. The research is inspired by needs of real decision making problems.

The group specializes in implementing old and new interactive multiobjective optimization methods as open-source software in the modular DESDEO framework. DESDEO is a free and open-source Python-based framework for developing and experimenting with interactive multiobjective optimization. The mission of DESDEO is to increase the awareness of the benefits of interactive methods and make them easily available and applicable. The framework consists of reusable components that can be utilized for implementing new methods or modifying the existing ones. Besides methods, DESDEO also includes user interfaces for them, and the group pays attention in user interface design taking human cognitive and affective processes into account. DESDEO currently contains the implementations of multiple interactive and non-interactive methods. Among the interactive methods available in DESDEO are the synchronous NIMBUS method, different variants of the NAUTILUS method family (including NAUTILUS Navigator), Wierzbicki's reference point method, Pareto Navigator, PBEA, interactive RVEA, and interactive NSGA-III. The list of non-interactive methods in DESDEO includes ϵ -constraint method, IBEA, RVEA, NSGA-III, MOEA/D, EvoNN and BioGP. Having many methods in the same framework enables method comparison and DESDEO includes, for example, artificial decision makers for comparing interactive methods without humans.

The general theoretical and methodological development in the group focuses on methods that are suitable and applicable for industrial or other real applications. In addition, the methods developed are independent of the application, so they can be utilized for solving different problems.

The group has a weekly seminar and vast international collaboration networks. Members of the group publish research articles actively. Visitors are welcome for longer or shorter periods.

For more information about the Multiobjective Optimization Group, see the group's website: <http://www.mit.jyu.fi/optgroup>

New interactive multiobjective evolutionary algorithm with different preference incorporation styles

Multiobjective optimization problems involve multiple conflicting objectives to be considered simultaneously. An optimization process for these problems typically involves exploring a particular set of compromise solutions known as the Pareto optimal set. Evolutionary algorithms have been widely employed to solve multiobjective optimization problems, as these algorithms can efficiently approximate the Pareto optimal set. However, real-world applications involve a decision maker (DM), a domain expert who is typically interested in a specific region, known as the region of interest, of the Pareto optimal set defined by their preference information. A multiobjective optimization process aims to support the DM in finding their most preferred solution(s) in the region of interest. Preference information can be considered before, during, or after the optimization process to help the DM find their most preferred solution(s). Interactive methods allow the DM to provide preference information iteratively during the optimization process. We can commonly identify two phases when utilizing an interactive method: learning and decision phases. The DM explores viable solutions during the learning phase until they find a region of interest that meets their preferences. Then, in the decision phase, the DM fine-tunes the solutions in the region of interest until they find the most preferred solution(s).

Although many multiobjective evolutionary algorithms have been proposed in the literature, there is still a considerable gap between theory and practice because in the literature, the needs of real DMs are often ignored. The interactive multiobjective evolutionary algorithms available in the literature are typically restricted to a single type of preference information. However, it would be beneficial to allow DMs to express preferences in different ways. The interested candidate will develop a new interactive multiobjective evolutionary algorithm that can handle more than one type of preference information. The existing modules of the DESDEO framework [1] can be utilized in this.

The work developed during the scholarship will be implemented as open-source software and will be potentially part of the DESDEO framework. The modular DESDEO framework is free open-source software. The mission of DESDEO is to increase awareness of the benefits of interactive methods and make them more easily available and applicable. The framework consists of reusable components that can be utilized for implementing new methods or modifying the existing methods.

Requirements: Background in multiobjective optimization, programming experience in Python, knowledge of evolutionary algorithms, readiness to contribute to open-source software, ability to work in a team in English.

Multiobjective optimization group website: <http://www.mit.jyu.fi/optgroup/>

DESDEO website: <https://desdeo.it.jyu.fi/>

Reference:

[1] G. Misitano, B. S. Saini, B. Afsar, B. Shavazipour and K. Miettinen, "DESDEO: The Modular and Open Source Framework for Interactive Multiobjective Optimization," in IEEE Access, vol. 9, pp. 148277-148295, 2021, doi: 10.1109/ACCESS.2021.3123825.