Multi-objective Combinatorial Optimization: Beyond the Biobjective Case

Kickoff Workshop in Wuppertal 22.2.2016

Program		
09:30	Tristan Cazenave, **Marek Cornu**, Daniel Vanderpooten	A two-phase meta-heuristic applied to the Multi-objective Traveling Salesman Problem Recently, a number of hybrid meta-heuristics have been successfully applied on different problems like the MO Traveling Salesman Problem (TSP), the MO Multidimensional Knapsack Problem and the MO Flow-shop Scheduling Problem. We present a method providing a general two-phase framework for finding an approximation of the non-dominated set. The first phase approximates the supported non-dominated set. A new approach is proposed to explore the weight space when the number of objectives is greater than two. The second phase combines scalarization-based and MO local search techniques to refine the non-dominated set. The method is compared to state-of-the-art algorithms on bi-objective and tri-objective TSP instances
	Marco Milano	Descent Methods for Nonlinear Multiobjective Optimization Multiobjective descent algorithms for nonlinear multiobjective optimization problems iteratively find descent directions common to all objectives and, under appropriate assumptions, converge to a Pareto critical point. In this talk several approaches of descent algorithms for the approximation of the Pareto-front for convex biobjective nonlinear optimization problems are discussed.
	Satya Tamby	BBC: A generic method for computing the set of nondominated points of multiobjective discrete optimization problems The epsilon constraint method is very efficient for computing the set of nondominated points in the bi-objective case. This is mainly due to the fact that the number of budget constrained models to be solved to generate this set is just one unit larger than the cardinality of this set. Several approaches have been proposed recently to generalize the epsilon constraint method to more than two objectives. They vary in their way of exploring the objective space and consequently on the number of budget constrained models to be solved. We propose a new approach based on the explicit representation of the search region, which aims at reducing the number of models to be solved. Experimental results are quite promising. By focusing on some specific search zones the method can also be used to compute the nadir point.
13:00	*Lunch Break*	

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14:30	**Britta Schulze**, Kathrin Klamroth, Michael Stiglmayr	Computation of supported efficient solutions for unconstrained m-objective binary optimization problems We consider unconstrained m-objective binary optimization problems and analyze the structure of these problems to compute the set of supported efficient solutions. As is known, the weighted sum scalarization can be used to compute all supported efficient solutions. The resulting problems have one single objective and are very easy to solve, since variables with positive coefficients are set to one and variables with negative coefficients are set to zero. The weight space of the scalarization can be decomposed by an arrangement of hyperplanes defined by the weighting of the coefficients corresponding to each variable, respectively. This structure induces a bound on the number of extreme supported efficient solutions and an approach for computing all supported efficient solutions. As a concrete example, we present an unconstrained 3-objective binary optimization problem with only positive coefficients in one objective and only negative coefficients in the remaining objectives.
	Sami Kaddani	Weighted sum model with partial preference information: Efficient application to Multi-Objective Optimization Decision makers tend to define their optimization problems as multi-objective optimization problems. Solving them is usually performed by two approaches: computing the nondominated set or using a scalarization function to select a most preferred solution. The first approach is limited by the computation time of the existing algorithms when the number of objectives is too high, while the second is demanding in terms of parameters definition. An intermediate approach consists in using partial preference information, which yields fewer points than the nondominated set decreasing the computation time. In this work we focus on a preference relation based on the weighted sum aggregation, where weights are not precisely defined. We exhibit noteworthy properties of this preference relation and introduce an efficient and generic way to use it in existing multi-objective optimization algorithms. This approach shows competitive performances both on computation time and quality of the generated preferred set.
	David Willems	A Sandwich Approximation Algorithm for biobjective optimal control problems A wide variety of different numerical methods have been developed to compute the trajectories of optimal control problems on the one hand and to approximate Pareto sets of multiobjective optimization problems on the other hand. However, so far only few approaches exist for combining both problems, leading to multiobjective optimal control problems. In this talk we present such an approach motivated by a biobjective optimal control problem that arises in the modeling of Dengue Fever: The population of Aedes mosquitos or other vectors is minimized as one criterion and, as a second, the cost of the vaccination or other types of control are taken into account. The Pareto set provides the best possible information in such a multiobjective decision making process. However, computing all Pareto solutions is not possible for this continuous problem. We adopt the Sandwich Algorithm of Burkard, Hamacher and Rote to approximate the Pareto set. With our algorithm, an $(1+\varepsilon)$-approximation of the Pareto set can be computed. Further, the algorithm terminates in time $\mathcal{O}(c/\varepsilon \cdot \mathrm{T}_{\mathrm{ALG}})$, where $\mathrm{T}_{\mathrm{ALG}}$ is the time needed to solve a single objective optimal control problem and c is the Euclidean distance between the lexicographic minima.
19:00	*Dinner*	

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Venue

The seminar will be at the University of Wuppertal (Campus Grifflenberg), in Building D, Level 13, Room 15. Form Wuppertal main station (bus stop: Historische Stadthalle) you reach the University of Wuppertal (Campus Grifflenberg) by bus lines 615, 645, 603 and 625. Building D is located just behind the main entrance.