Biography:

Marco Lübbecke is a full professor and chair of operations research at RWTH Aachen University, Germany. He received his Ph.D. in applied mathematics from TU Braunschweig in 2001 and held positions as assistant professor for combinatorial optimization and graph algorithms at TU Berlin and as visiting professor for discrete optimization at TU Darmstadt.

Marco's research and teaching interests are in computational integer programming and discrete optimization, covering the entire spectrum from fundamental research and methods development to industry scale applications. A particular focus of his work is on decomposition approaches to exactly solving large-scale real-world optimization problems. This touches on mathematics, computer science, business, and engineering alike and rings with his appreciation for fascinating interdisciplinary challenges.

Title and Abstract:

A Dantzig-Wolfe Hierarchy for the Stable Set Problem

The stable set problem is an important subproblem in many practical applications. It has been studied extensively also from a theoretical point of view. In particular, the problem is a poster child for the study of the strength of (the relaxations of) many different formulations for the problem. Dantzig-Wolfe reformulation is a general technique for obtaining strong formulations for a problem. We first motivate connecting the two topics by some computational observations about Dantzig-Wolfe reformulations of a classical ("edge") formulation for the stable set problem. For this model, each reformulation can be associated with a subset of the edges of the original graph, thus a subgraph. In fact, we have exponentially many options for selecting such a subgraph and we are able to characterize which reformulations are strongest and weakest possible. Only recently, we fully understood also the reformulations in between the extremes. More precisely, we can show that any two reformulations lead to identical polyhedra if and only if the corresponding reformulated subgraphs contain the same odd induced cycles. This lends itself to the notion of a hierarchy of Dantzig-Wolfe refomulations which is the first such concept in the Dantzig-Wolfe context.

This is joint work with Michasel Bastubbe, Adrian Gallus, and Jonas Witt.