

## Improved Lower Bounds for Node and Arc Routing Problems

Marcus Poggi, Eduardo Uchoa, Artur Pessoa, Rafael Martinelli, Henrique Viana,

Diego Pecin, Humberto Longo

The talk addresses the main techniques aiming at the exact solution of routing problems. Compact and extended formulations, cycle elimination and elementary routes when solving by column generation, recent valid inequalities, speeding-up techniques and branching strategies are combined to produce new lower bounds and prove optimality of open instances. We play with those elements on instances of the CARP, CVRP and TOP. We focus on the analysis of the pros and cons of using each of the, assumed bound improving, elements listed above. We compare the bounds obtained with combination of mild choices against the ones with the use of more aggressive techniques. An extensive computational experience is presented and a few guidelines can be drawn.