Solving Wireless Network Design Problems by Cycle Deletion

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Abstract: The impressive development experienced by wireless networks during the past years has generated need for sophisticated optimization tools that must be able to better exploit scarce radio resources and effectively design advanced technical features of next generation networks.

In this work, we study a new approach to the solution of the Wireless Network Design Problem (WND), that is the problem of establishing the location and radio-electrical configuration of the transmitters that constitute a wireless network, with the aim of maximizing service coverage.

Classical models for the WND make use of Mixed-Integer Programs that are characterized by very ill-conditioned constraint matrices and include the notorious big-M coefficients to model disjunctive constraints. The resulting problems are very hard to solve and heavily suffer from numerical instabilities.

Our contribution consists in a pure 0-1 Linear Programming formulation for the WND, whose inequalities can be used to strengthen the classical Mixed-Integer formulations. The separation of such inequalities corresponds to the deletion of negative cycles in a suitable graph associated with the problem. We assess the effectiveness of our approach by computational experience on a set of realistic instances defined in collaboration with our industrial partners.

References

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