

# Shared Protection Network Design: MILP and MINLP models

Pietro Belotti

Dept. of Industrial and Systems Engineering, Lehigh University, Bethlehem PA.

The problem consists in finding the network capacity necessary to route a set of point-to-point traffic demands while minimizing the total network capacity cost. The capacity should be sufficient to accommodate, for each traffic demand, *two* disjoint paths: a *working* path, used in nominal conditions, and a *backup* path, disjoint from the working path. The *Shared Protection* feature is defined in all models by a bottleneck constraint imposed on the arc capacity variable  $Y_{ij}$ .

This submission includes two MILP models and one MINLP model. All three are multicommodity network flow models, and differ for the way shared protection is modeled. The first MILP model has been described by Amiri and Pirkul [1] as a derivation from the MINLP model, while the second MILP model derives from standard tricks in network design literature.

## References

1. A. Amiri, H. Pirkul, Primary and secondary route selection in backbone communication networks, *European Journal of Operational Research* **93**, 1996, 98–109.