Ben-Ameur, W.; Pióro, M.; Żotkiewicz, M.
Fractional routing using pairs of failure-disjoint paths. (English) Zbl 1326.90011

Summary: Given a set of commodities and a network where some arcs can fail while others are reliable, we consider a routing problem with respect to a survivability requirement that each commodity can be split among pairs of failure-disjoint paths. Two paths $p$ and $p'$ form a pair of failure-disjoint paths if they share only reliable arcs. The same flow is sent over $p$ and $p'$, but the flow sent on a common reliable arc is not doubled.

We present a compact linear formulation of the problem. Also three non-compact formulations solvable by column generation are introduced. In the first formulation, the generated columns correspond to pairs of failure-disjoint paths, while in the second formulation the generated columns correspond to simple paths. The third formulation is solved by generating pairs of arc-disjoint paths. All formulations are compared numerically. On top of that we study some generalizations and some special cases of the problem of computing a shortest pair of failure-disjoint paths. One of these generalizations is equivalent to a single-commodity capacitated network design problem.

MSC:

90B15 Stochastic network models in operations research
90B25 Reliability, availability, maintenance, inspection in operations research
90C35 Programming involving graphs or networks

Keywords:
shortest paths; disjoint paths; compact formulations; column generation; capacitated network design

Software:

CPLEX; SNDlib

Full Text: DOI

References:


[17] Pióro, M.; Medhi, D., Routing, flow, and capacity design in communication and computer networks, (2004), Morgan Kaufman San Francisco, CA, USA · Zbl 1069.68021


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