On Survivable Network Polyhedra

H. Kerivin[1] and A.R. Mahjoub[2]

1. Institute for Mathematics and its Applications, University of Minnesota, 357 Lind Hall, 207 Church Street S.E., Minneapolis, MN 55455-0436, USA

2. LIMOS, CNRS UMR 6158, Université Blaise Pascal Clermont II, Complexe Scientifique des Cézeaux, 63177 Aubière Cedex, France

Ridha.Mahjoub@math.univ-bpclermont.fr

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Abstract

Given an undirected network $G = (V, E)$, a vector of nonnegative integers $r = (r(v) : v \in V)$ associated with the nodes of G and weights on the edges of G, the survivable network design problem is to determine a minimum-weight subnetwork of G such that between every two nodes u, v of V, there are at least $\min\{r(u), r(v)\}$ edge-disjoint paths. In this paper we study the polytope associated with the solutions to that problem. We show that when the underlying network is series-parallel and $r(v)$ is even for all $v \in V$, the polytope is completely described by the trivial constraints and the so-called cut constraints. As a consequence, we obtain a polynomial time algorithm for the survivable network design problem in that class of networks. This generalizes and unifies known results in the literature. We also obtain a linear description of the polyhedron associated with the problem in the same class of networks when the use of more than one copy of an edge is allowed.