Redundant by Design

For today's networked economies and societies, from business process outsourcing and collaborative fulfillment to social networking and distance learning, infrastructure networks that carry materials, information, and energy are vitally important. So, even seemingly localized disruptions—a beaver chewing a fiber-optic cable, an interstate overpass collapsing, a tree falling over power transmission lines, or a strike by dockworkers—can endanger lives and cause enormous economic losses if traffic is not swiftly rerouted around the disrupted link. While real-time disruption management and network restoration capabilities are important, the resilience of a network rests fundamentally on its topological design. By judiciously installing redundant links, network planners can make the networks immune to disruptions by creating alternate paths for critical traffic. To address this important but computationally difficult problem, the paper "Connectivity Upgrade Models for Survivable Network Design" by A. Balakrishnan, P. Mirchandani, and H. P. Natarajan develops theoretical results to enhance the model formulation, and proposes a solution methodology combining a cutting plane procedure with an optimization-based heuristic. Extensive results, based on carefully designed computational experiments, demonstrate that the proposed algorithm generates near-optimal solutions, making it valuable for practical decision-support systems.