Light Vertex Fault Tolerant Graph Spanners via Connected Dominating Sets

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Fault-tolerant graph spanners are sparse subgraphs that approximately preserve distances (up to some stretch) in the presence of vertex or edge failures. Classical work on graph spanners has focused on tradeoffs between stretch and size, measured either by the number of edges (sparsity) or by total weight relative to a minimum spanning tree (lightness). Only more recently has attention turned to spanners that are robust to vertex or edge failures.

In this talk, we study light vertex fault-tolerant spanners, with the goal of quantifying the tradeoffs between low stretch, high robustness to vertex failures, and small lightness. Our in-progress framework is based on connected dominating sets (CDSs). Specifically, we aim to prove a Steiner analogue of a result by Censor-Hillel, Ghaffari, and Kuhn (2013), which shows that every k-vertex-connected graph on n vertices admits a CDS partition of size $\Omega(k/\log^5 n)$. If successful, this framework would allow us to decompose the graph into components robust to vertex failures and to bound the total weight of each component. We also propose alternative approaches for studying light vertex fault-tolerant spanners.