1150-05-151 **Mark Ellingham*** (mark.ellingham@vanderbilt.edu), **Songling Shan**, **Dong Ye** and **Xiaoya Zha**. *Toughness and spanning trees in K_4-minor-free graphs.*

For an integer k, a *k-tree* is a tree with maximum degree at most k. More generally, if f is an integer-valued function on vertices, an *f-tree* is a tree in which each vertex v has degree at most $f(v)$. Let $c(G)$ denote the number of components of a graph G. We investigate spanning trees in K_4-minor-free graphs, which are identical to graphs of treewidth at most 2, and generalize series-parallel graphs. We show that if G is a connected K_4-minor-free graph and

$$c(G-S) \leq \sum_{v\in S}(f(v)-1) \quad \text{for all } S \subseteq V(G) \text{ with } S \neq \emptyset$$

then G has a spanning f-tree. Consequently, if G is a $\frac{1}{k-1}$-tough K_4-minor-free graph, then G has a spanning k-tree, which strengthens a result for general graphs due to Win. Examples show that this inequality cannot be relaxed by adding 1 to the right-hand side. (Received July 05, 2019)