

1. Distinguish matroid element “ports” associated with electric or elastic system parameter and solution variables of interest. (All vars are paired: (voltage, current), (force, displacement), etc. One gets a pair of submodels with dual matroids in elementary situations; not duals otherwise.)
2. Exterior algebra forms of deletion and contraction of a non-port yield a pair of simpler systems.
3. Cancelling non-port elements with a kind of bilinear pairing yields the parameter/solution variables of interest relation, in the form of an **exterior algebra valued function** of systems, that **is a Tutte function** (when the minor and direct sum operations are sign-consistent).

With the suitable incidence matrix form, we get the all-minors matrix tree theorem; but all the minors are packed into **one exterior algebra object** that is a Tutte function of graphs.

Seth Chaiken, Assoc. Prof. Emeritus, University at Albany.