Abstract: Consider a directed graph *D* whose vertices are colored by real numbers. Every vertex computes its own *value*: the sum of incoming colors minus the sum of outgoing colors (or vice versa). A coloring of *D* is *non-vanishing* if the value of every vertex is non-zero. How many colors are needed for a non-vanishing coloring of *D*? We conjecture that every digraph *D* having a *perfect matching* has a non-vanishing coloring by just *three* real numbers (for instance, 1, 2, 3). This statement implies the famous 1-2-3 Conjecture and is implied by a more general conjecture of Niwczyk, which in turn is a special case of a conjecture of Saxton.
In a similar flavor, a coloring of a hypergraph *H* is *non-vanishing* if the sum of colors in every edge is non-zero. Trivially, every hypergraph has a non-vanishing coloring by just *one* real number (provided it is not zero), but the *list coloring* version of the problem is highly non-trivial. Suppose, for instance, that *H* is a *complete* hypergraph on *n* vertices (every non-empty subset is an edge in *H*). Goddyn and Tarsi conjecture that this hypergraph has a non-vanishing coloring from arbitrary lists of size $n + 1$, which is best possible. This problem has an intriguing connection to the Lonely Runner Problem, and also leads to the "non-vanishing" version of the famous Rota Basis Conjecture (stating that every matroid of rank *n* which is a disjoint union of *n* bases can be split into *n rainbow* bases).