Kirchhoff Graphs

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Given a set of n vectors in any vector space over the *rationals*, suppose that $k < n$ are linear independent. Kirchhoff graphs are vector graphs (graphs whose edges are these vectors), whose cycles represent the dependencies of these vectors and whose vertex cuts are orthogonal to these cycles. This presentation introduces these graphs and discusses how graph tiling can generate families of Kirchhoff graphs. These families are composed of prime graphs (those having no Kirchhoff subgraphs), and composite graphs (not prime), all generated by a set of fundamental Kirchhoff graphs (smallest prime Kirchhoff graphs that can generate all other known prime and composite graphs for our set of vectors). Because of the vector dependencies they represent, Kirchhoff graphs can also represent binary matroids. This work depends on the numerical construction of Kirchhoff graphs.

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