THE LAPLACIAN MATRIX

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The course is conceived as an introduction to the discrete Laplacian and related combinatorial and algebraic techniques.

Themes to be considered:

- Kirchhoff's matrix tree theorem

- Lindstrom-Gessel-Viennot lemma for directed acyclic graphs with applications to determinants, in particular for graph-based Binet-Cauchy theorem proof

- Helmholtz-Hodge decomposition on graphs and hypergraphs with applications to algebraic topology and construction of canonical forms for complex matrices under unitary similarity.

- some polygonal tiling problems

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