Kemeny's constant and a twin paradox for graphs

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Part of this talk is on a joint work with ***Geir Dahl*** *(University of Oslo) and* ***Steve Kirkland*** *(University of Manitoba).*

Kemeny's constant is a measure of the circulation smoothness in a discrete-time Markov chain. In the first part of this talk, we focus on the Markov chains corresponding to random walks on trees. By looking at two particular families of trees – caterpillars and broom-stars – we provide lower and upper bounds on Kemeny's constant for the random walks on generic trees in terms of their order and diameter.

Sometimes, closing a portion of a road network makes the circulation smoother. This phenomenon – known as the *Braess' paradox* – can also be observed in the context of random walks on graphs. In the second part of the talk, we identify a large class of graphs exhibiting such a paradoxical behavior – namely, the connected graphs having a pair of twin pendent vertices. We also investigate the occurrence of the Braess' paradox in random graphs, showing that *almost all* connected planar graphs are paradoxical. These findings extend analogous results already established for the class of trees. Our method consists in turning the graph into an electric circuit, connecting a battery across two of its vertices, and exploiting a relation between the electrical resistance in the circuit and Kemeny's constant.