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Electrical resistance and connectivity of graphs MIKHAIL KAGAN, Penn State Abington — One of the basic tasks related to electrical circuits is computing equivalent resistance. In some simple cases, this task can handled by combining resistors connected either in series or in parallel, until the original circuit reduces to a single element. When this is not possible, one resorts to the "heavy artillery" of Kirchhoff's rules. What traditionally receives little to no attention in the introductory E&M class is the method of nodal potentials. At the same time, it may often be both mathematically and conceptually simpler. In this talk, I will review the method of nodal potentials and use it to find the unknown currents and voltages in the Wheatstone-Bridge-like circuit. At the end, I will derive - in a closed form - the equivalent resistance of a generic circuit. Given the breadth of physical intuition that we have about electrical circuits, this result can provide a great deal of insight into some important questions of graph theory (e.g. connectivity issues, random walks on graphs etc.), as well as its applications to computer science.

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