Title

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Abstract

Madry '16 (Computing Maximum Flow with Augmenting Electric FlowS) presents a $O(m^{10/7}U^{1/7})$ time algorithm for computing max flows. He does so via an 'interior point method', by maintainig a primal flow and a 'dual' (which seems to be an embedding into a line. What is the dual of the max flow, and why is it line embeddable?).

He maintains this feasible flow by finding an electrical flow with some resistor setting built from the residual flow (large resistor if low residual flow), and adds a small multiple of this electric flow to the actual flow. Then he uses some mysterious cycle-updating trick to make sure the primal and dual are 'well compled' (or as close to it as they can be), whatever this means.

Madry maintains the dual for the purpose of helping his preconditioninng arcs idea, which is designed to make each step make some progress. But the math here, as with all optimization, is a large large mystery. The dual is apparently some kind of certificate that a demand is feasible, but it's not clear when a demand would not be feasible given augmenting-paths-based solutions.

Why does this work? It really seems like it should not. I don't have any reason to believe the math works out.