

# Fast gradient methods for network flow problems

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## Abstract

In this talk we present a new approach for finding approximate solutions to different network problems related to multi-commodity flows. We consider simple subgradient schemes and schemes based on the smoothing technique. The fastest of our methods solves the maximal concurrent flow problem in  $O(\frac{qm}{\delta})$  iterations, where  $\delta$  is the related accuracy,  $m$  is the number of arcs in the graph, and  $q$  is the number of commodity sources. Each iteration of these schemes is very simple and does not require any sophisticated operations (e.g. shortest path computation). Its complexity is of the order  $O(mq \ln q)$  operations. The application of our approach needs a preliminary computational stage consisting in finding all node-to-node maximal flows, which takes  $O(n^2 m \ln n)$  operations, where  $n$  is the numbers of nodes in the graph.