数学系综合学术报告

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Rooted Routing Via Structural Graph Theory

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Bruce Reed，加拿大麦吉尔大学和日本国立情報学研究所教授。自2001年起一直担任加拿大图论研究讲席，2002年在国际数学家大会做邀请报告，2009年当选加拿大皇家学会会士，2013年荣获加拿大数学科学最高奖，CRM-Fields-PIMS奖。 他在图子式、图染色、算法图论、随机图、图算法随机分析以及巨大网络研究等方面作出了一系列杰出贡献。他在上海的系列讲座将由浅入深的介绍图子式及其算法应用，内容取材于其即将出版的研究专著Graph Minors I: Rooted Routing。详情请见：
http://math.sjtu.edu.cn/conference/bannai/2013/home.php

报告摘要

Finding ways of getting from place to place has occupied humanity since the dawn of civilization. The Qin Dynasty built roads, the Han dynasty developed junks, the Ministry of Railways builds high speed networks. Mathematicians settle for studying graphs.

A graph is a set of vertices and a set of edges, each of which links a pair of vertices. Thus, graphs may abstractly represent the highways (edges) linking a set of cities (vertices), the bridges linking the islands of an archipelago, or the wires of a telephone network.

A path through a graph is a sequence of distinct vertices, consecutive elements of which are linked through an edge. Routing problems involve finding a path, or set of paths, through a graph satisfying various constraints. Google Map's Get Directions needs to find a shortest path linking two specified points in a network of streets. A telephone company needs to route the calls through their network so as to minimize congestion. Graph theorists are interested in developing efficient algorithms for such problems.

We will discuss an efficient algorithm for the problem of determining, given a graph G and a set $\{s_1,\ldots,s_k, t_1,\ldots,t_k\}$ of $2k$ terminal vertices, whether there are k vertex disjoint paths of G, $P_1,\ldots,P_k$ such that P_i links s_i to t_i.

If the graph is sufficiently connected this problem is easy to solve. For example, if there is an edge between every pair of vertices then we can simple set P_i to be s_i, t_i . We show that for graphs which have connectivity faults, we can solve the problem quickly because we can obtain structural decompositions of the graph into simple pieces. As we discuss, the deep and seminal results of Robertson and Seymour's Graph Minors Project tell us that we can solve our routing problem on any graph by combining these two approaches.

The presentation assumes no previous knowledge of graph theory and is directed at a general audience.