Improved Bounds on Edge Forwarding Index of Networks

Indra Rajasingh¹, R. Sundara Rajan¹, N. Parthiban², and Paul Manuel³

¹School of Advanced Sciences, VIT University, Chennai, India, 600 127
²School of Computing Sciences and Engineering, VIT University, Chennai, India, 600 127
³Department of Information Science, Kuwait University, Safat, Kuwait, 13060

Abstract. There are large number of graph optimization problems which arise in network design and analysis. A well-designed interconnection network makes efficient use of scarce communication resources and is used in systems ranging from large super computers to small embedded system on a chip. A designer of interconnection networks has to take into account communication speed, high robustness, rich structure, fault tolerance and fixed degree.

Routings are important functions of communication networks. The choice of a routing in a network directly affects efficiency of communication and performance of the network. There are many parameters to measure the quality of a routing. In this poster we consider one of the parameters namely the forwarding index, which is used to measure the load of a vertex or the congestion of an edge. It is quite natural that a good routing should not load any vertex or edge too much, in the sense that not too many paths specified by the routing should go through it.

Let $G$ be a connected undirected graph or a strongly connected digraph with order $n$. A routing $R$ in $G$ defines a set of $n(n-1)$ fixed paths for all ordered pairs $(x,y)$ of vertices of $G$. The path $R(x,y)$ specified by $R$ carries the data transmitted from the source $x$ to the destination $y$. If $R(x,y)$ is not a direct edge, then the internal vertices of $R(x,y)$ can serve as a forwarding function for the data being communicated between the vertices.

The congestion of an edge $e$ in a routing $R$ is the number of paths of $R$ going through it, and is denoted by $\Pi(G,R,e)$. The edge-forwarding index of a routing $R$ in a graph $G$ is defined as

$$\Pi(G,R) = \max \Pi(G,R,e)$$

where the maximum is taken over all edges $e$ of $G$. Then, the edge-forwarding index of $G$ is defined as

$$\Pi(G) = \min \Pi(G,R)$$

where the minimum is taken over all routings $R$ of $G$. 