

Siemens Competition

Math : Science : Technology

Regional Finalist

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High School: Troy High School

Mentor: Dr. Eddie Cheng

Project Title: *Structural Properties of 2-Bijective Connection Networks*

In parallel processing, how well a certain network performs is directly related to its structure; these networks can be modeled using graphs, with vertices representing nodes and edges representing the links between the nodes. Several well-known interconnection networks, such as the hypercube and twisted cube, are formed by taking two graphs and adding a perfect matching between them. In our paper, we considered a variant of these graphs: the class of 2-Bijective Connection Networks, a set of recursively defined graphs in which the next level is created by adding two disjoint perfect matchings between any two members of the previous level. We found several encouraging results about the 2-BCN, showing that the deletion of a large number of edges or vertices still resulted in an intact core; in fact, the number of vertices or edges deleted was found to be linear with respect to the regularity of the graph. Moreover, we applied these results to calculate other properties of the 2-BCN, such as the matching preclusion number and the diameter. Overall, we found that the 2-BCN's robustness and strength, along with the versatility regarding the choice of the matchings, make the class of graphs a viable choice for future use in parallel processing networks.