

A research project

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A spatial graph is a graph embedded in S^3 . If the graph consists of two vertices and three edges such that each edge joins the vertices, then it is called the θ -curve. In master's thesis, I constructed a notation of a θ -curve by using a tangle and a θ -polyhedron, and enumerated all the prime θ -curves with up to seven crossings. We can enumerate all the prime θ -curves in order of crossing numbers by using my notation. Here, a θ -polyhedron is a connected planar graph without bigon, whose two vertices are 3-valent, and the others are 4-valent. Then there exist twenty-four prime basic θ -polyhedra with up to seven 4-valent vertices. We can obtain all the prime θ -curves from prime basic θ -polyhedra by substituting tangles for their 4-valent vertices.

I enumerate handcuff graphs, which are similar to θ -curves. Here, a handcuff graph is a spatial graph which consists of two loops and an edge joining the vertices of each loop. We can enumerate handcuff graphs with up to seven crossings by applying my notation. And I have already enumerated handcuff graphs with up to six crossings. I also consider making a table of all the prime θ -curves with up to eight crossings. In order to do this, I must construct a prime basic θ -polyhedron with up to eight 4-valent vertices, and then make a table of all the handcuff graphs with up to eight crossings and classify them.