A Polynomial time Algorithm for the Maximum Weight Independent Set Problem on Outerstring Graphs

J. Mark Keil [*], Joseph Mitchell [†], D. Pradhan [‡], Martin Vatshelle [§]

Abstract

Outerstring graphs are the intersection graphs of curves that lie inside a disk such that each curve intersects the boundary of the disk. Outerstring graphs are among the most general classes of intersection graphs studied, including among others, chordal graphs and interval filament graphs. To date, no polynomial time algorithm is known for any of the classical graph optimization problems on outerstring graphs, in fact most are NP-hard. It is known that there is an intersection model for any outerstring graph that consists of polygonal arcs attached to a circle. However, this representation may require an exponential number of segments relative to the size of the graph.

Given an outerstring graph and an intersection model consisting of polygonal arcs with a total of N segments, we develop an algorithm that solves the Maximum Weight Independent Set problem in $O(N^3)$ time. If the polygonal arcs are restricted to single segments, then outersegment graphs result. For outersegment graphs, we solve the Maximum Weight Independent Set problem in $O(n^3)$ time where n is the number of vertices in the graph.

[*]Department of Computer Science, University of Saskatchewan, Canada
[†]Department of Applied Mathematics and Statistics, State University of New York at Stony Brook, USA
[‡]Indian Institute of Technology, Jodhpur, India
[§]Department of Informatics, University of Bergen, Norway