

Two New Approximation Algorithms for the Maximum Planar Subgraph Problem*

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Abstract

The maximum planar subgraph problem (MPS) is defined as follows: given a graph G , find a largest planar subgraph of G . The problem is NP -hard and it has applications in graph drawing and resource location optimization. Călinescu et al. [J. Alg. 27, 269-302 (1998)] presented the first approximation algorithms for MPS with nontrivial performance ratios. Two algorithms were given, a simple algorithm which runs in linear time for bounded-degree graphs with a ratio $7/18$ and a more complicated algorithm with a ratio $4/9$. Both algorithms produce outerplanar subgraphs.

In this article we present two new versions of the simpler algorithm. The first new algorithm still runs in the same time, produces outerplanar subgraphs, has at least the same performance ratio as the original algorithm, but in practice it finds larger planar subgraphs than the original algorithm. The second new algorithm has similar properties to the first algorithm, but it produces only planar subgraphs. We conjecture that the performance ratios of our algorithms are at least $4/9$ for MPS.

We experimentally compare the new algorithms against the original simple algorithm. We also apply the new algorithms for approximating the thickness and outerthickness of a graph. Experiments show that the new algorithms produce clearly better approximations than the original simple algorithm by Călinescu et al.

Keywords: maximum planar subgraph, maximum outerplanar subgraph, thickness, outerthickness, triangular cactus heuristic, approximation algorithm

1 Introduction

A graph is *planar* if it admits a plane drawing where no two distinct edges intersect apart from their endpoints, otherwise the graph is *non-planar*. Let $G = (V, E)$ be a

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