Animation of Curve Constrained Drawings of Planar Graphs

[Video Submission to SoCG05
www.cs.uleth.ca/~vpak/socg05] *

Kim Hansen
Dept. of Math. and Computer Science
University of Lethbridge
Lethbridge, Alberta, Canada
kim.hansen@uleth.ca

Stephen Wismath
Dept. of Math. and Computer Science
University of Lethbridge
Lethbridge, Alberta, Canada
wismath@cs.uleth.ca

ABSTRACT

We submit an animation of an algorithm for drawing an arbitrary planar graph with vertices located on a semi-circle and edges drawn as straight line segments with at most one bend per edge. The animation, produced in `.avi` format, is available at: `www.cs.uleth.ca/~vpak/socg05`.

Categories and Subject Descriptors

I.2.9 [**Computing Methodologies**]: Computational Geometry, Graph Drawing

General Terms

algorithms

Keywords

animation, graph drawing

1. BACKGROUND

The paper *Curve Constrained Drawings of Planar Graphs* by DiGiacomo, Didimo, Liotta, and Wismath [2] was first presented in conference form at **WG 2003** (Workshop on Graph Theoretic Concepts in Computer Science) in June 2003. One of the main results of that paper is a graph drawing algorithm that takes as input an arbitrary planar graph and outputs a plane drawing of the graph with vertices placed on a semi-circle and with edges drawn crossing-free as polylines with at most 1 bend per edge. This result is somewhat surprising given the results of Kaufmann and Wiese [3] who showed that it is NP-complete to decide whether a planar graph is 1-bend drawable if the vertices are constrained to lie on a line. Figure 3 shows an example of a graph that cannot be drawn with 1 bend per edge if the vertices are placed on a line.

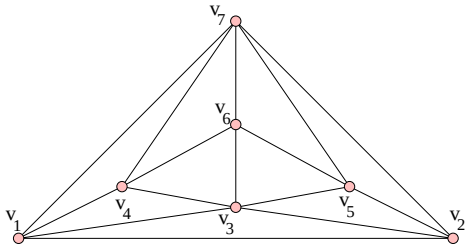

Figure 1: A canonically ordered planar graph

The algorithm of [2] draws the vertices of the input planar graph on a semi-circle by adding a new vertex and its incident edges iteratively. The next vertex to be inserted in the drawing is chosen by using the well-known canonical ordering defined by de Fraysseix, Pach, and Pollack [1]. Note that the ordering on the curve embedding is in general very different from the computed canonical ordering.

A critical invariant of the algorithm is that associated with each drawn vertex v is an interval on the semi-circle (α_v, β_v) that is unused. Edges to adjacent vertices of v that are not yet drawn can access v and maintain the invariant. Details of the algorithm can be found in the paper.

2. VIDEO

The submitted animation attempts to describe the algorithm of [2] briefly but effectively. The animation also demonstrates *_arXdeux_*, the shockwave software developed to interactively apply the algorithm. Finally, the web site for the paper is promoted – the paper, links to the demo software, some shorter animations, etc. are available at: `www.cs.uleth.ca/~vpak/gd`.

Most of the animation was produced with *3DStudioMax*. *Shockwave*/website screen captures were performed with TechSmith's *Camtasia Studio Recorder*. Soundtrack editing was done with *Adobe Audition*, and video post-processing was accomplished with Adobe *Premiere/Photoshop*.

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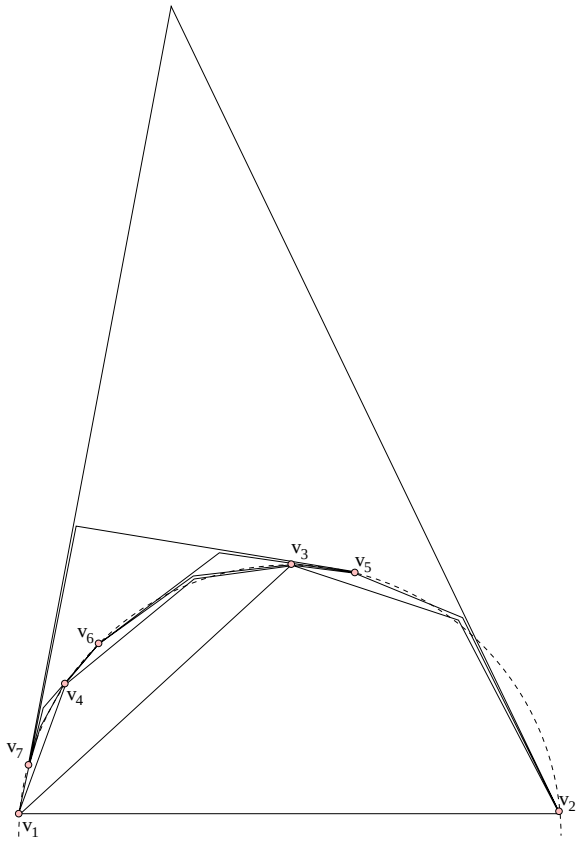

Figure 2: The planar graph drawn on a circle

Acknowledgment

Some of the figures in this abstract were produced by DiGiacomo, Didimo, and Liotta and their help is gratefully acknowledged.

3. REFERENCES

[1] H. de Fraysseix, J. Pach, and R. Pollack. How to draw a planar graph on a grid. *Combinatorica*, 10:41–51, 1990.

[2] E. DiGiacomo, W. Didimo, G. Liotta, and S. Wismath. Curve constrained drawings of planar graphs. *Computational Geometry: Theory and Applications*, Vol 30, No 1, Jan 2005, pp. 1–23.

[3] M. Kaufmann and R. Wiese. Embedding vertices at points: Few bends suffice for planar graphs. *Journal of Graph Algorithms and Applications*, 6(1):115–129, 2002.

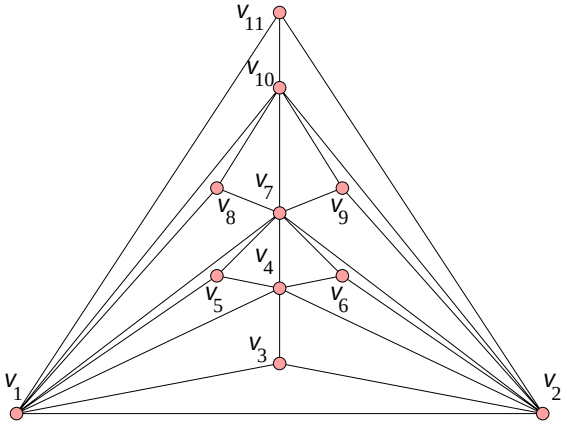

Figure 3: A graph not drawable with vertices on a line