On Some Kinds of Contact Graphs

Qays Shakir
National University of Ireland, Galway

Postgraduate Modelling Research Group

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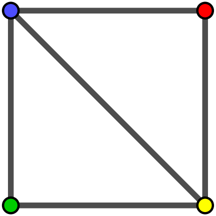
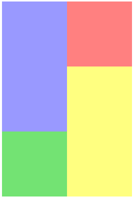
Contact Graphs

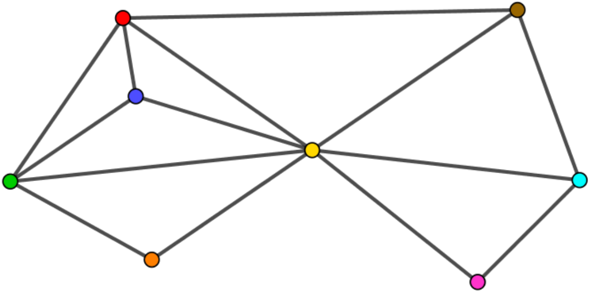
A contact graph is a graph whose vertices are represented by geometric objects (such as curves, line segments, or polygons) with no overlap, and edges correspond to two objects touching each other in a specific way.





Circle Packing Theorem

Circle Packing Theorem: Every plane simple graph can be realised as the contact graph of some arrangement of circles with nonoverlapping interiors in the Euclidean plane.



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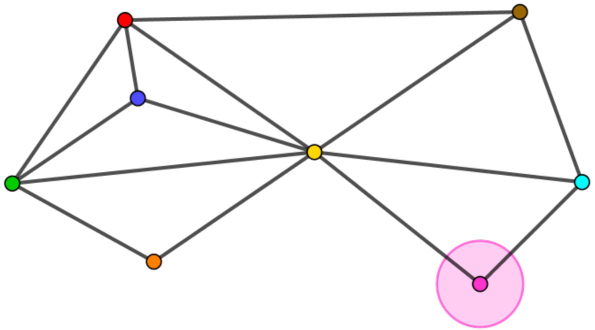

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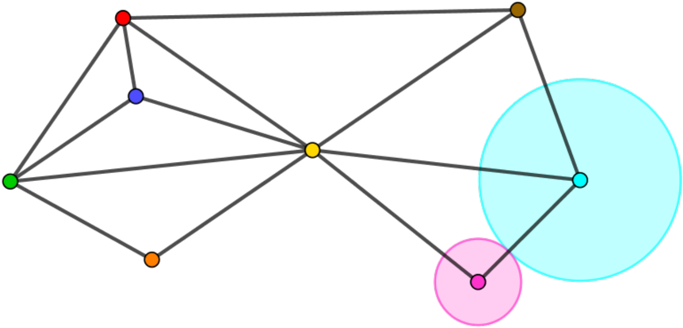

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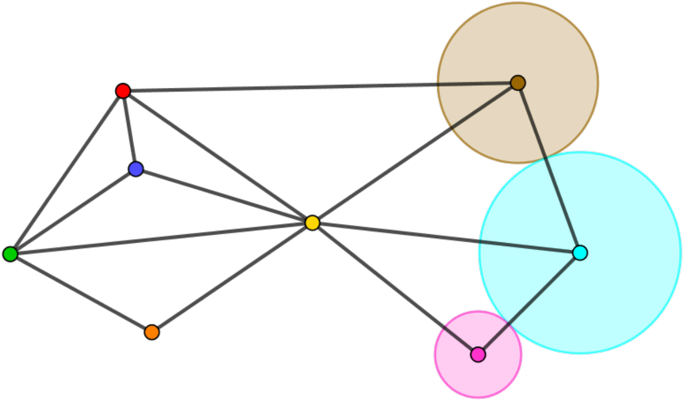

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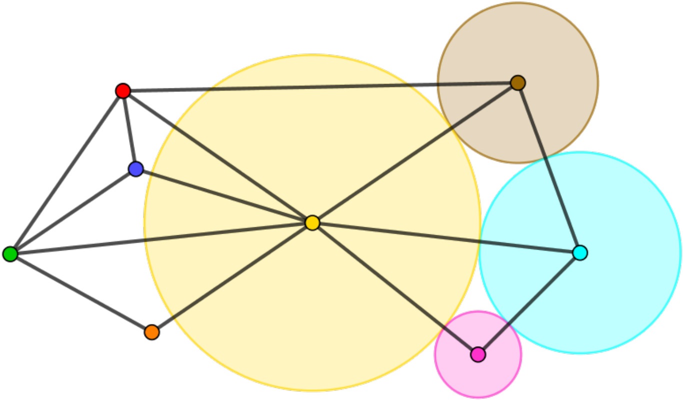

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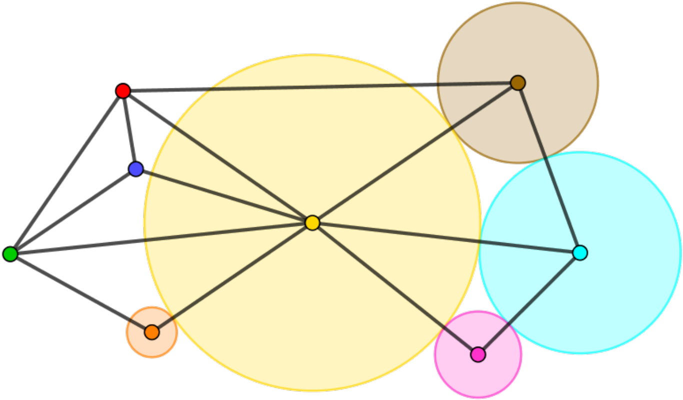

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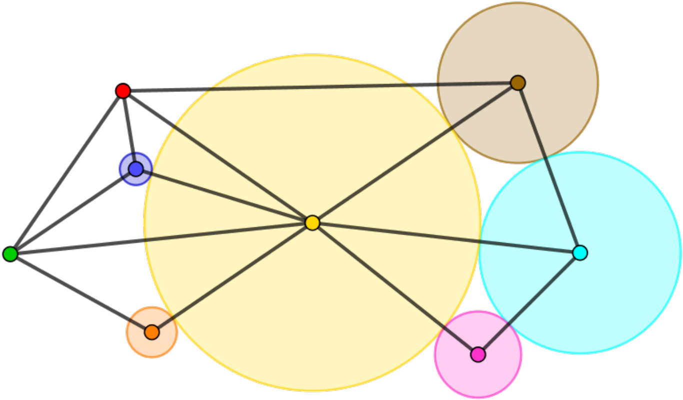

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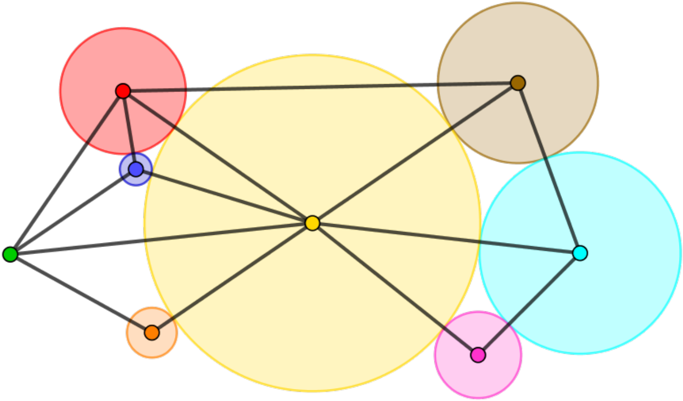

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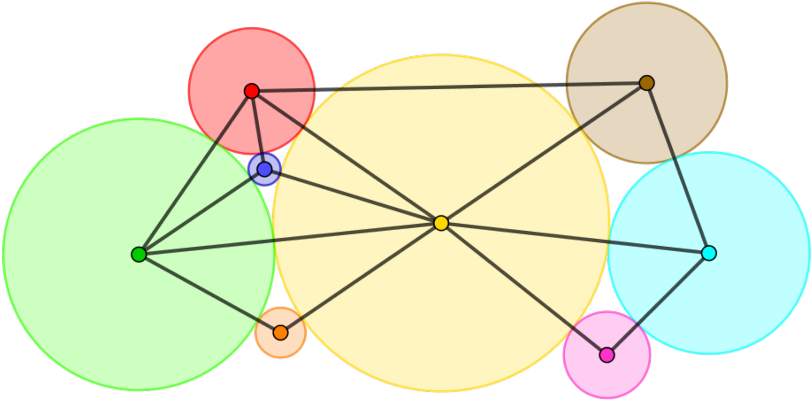
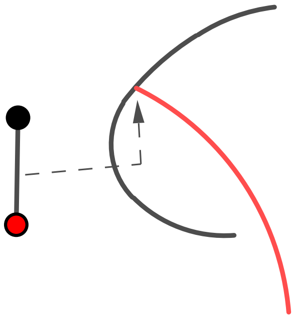


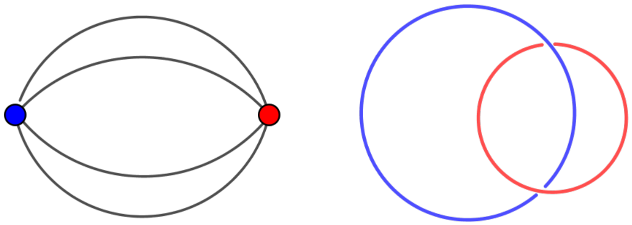
Curve Contact Graphs

A Curve contact representation of a surface graph G is a configuration of simple curves embedded in the surface so that the graph induced by the contacts between the arcs is isomorphic to G.



Contacts of Circular Arcs Representation

A Contacts of Circular Arcs (CCA) representation of a surface graph G is a curve contact graph such that each curve is a circular arc.



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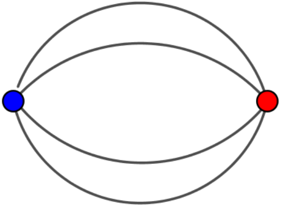

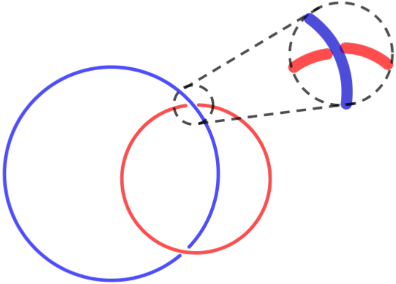

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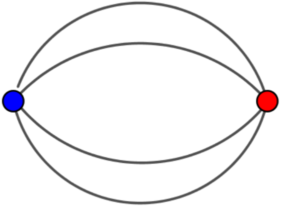

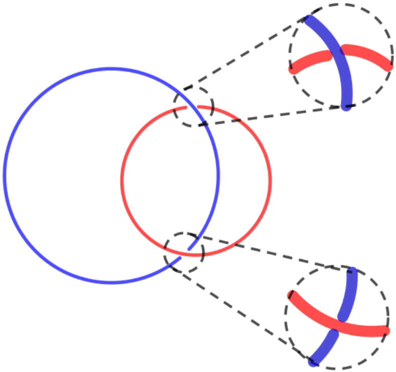

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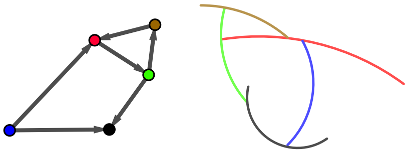
A CCA representation of a graph G induces an orientation on the edges of G.
Each vertex has an out degree of at most 2, it follows that G is $(2, 0)$-sparse.



Some Results on the Plane

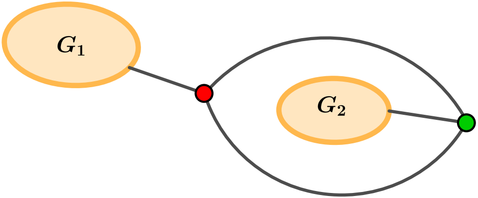
In 2015, M. Alam, David Eppstein et. al. presented the following theorem:

Theorem : Every plane $(2, 2)$-sparse graph has a CCA representation on the plane.

Question: Does every $(2, 0)$-tight plane graph has a CCA representation on the plane?

Answer: No

Example



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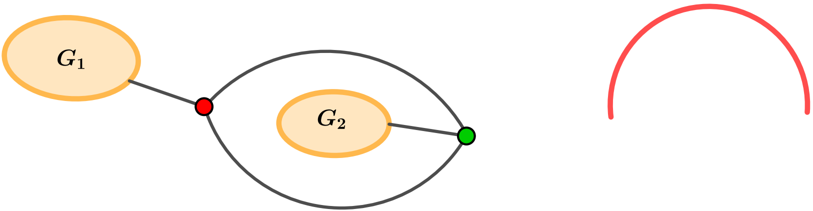

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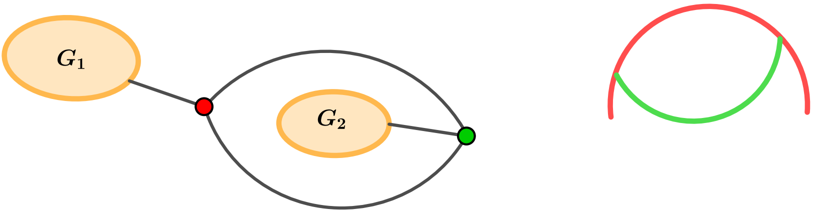

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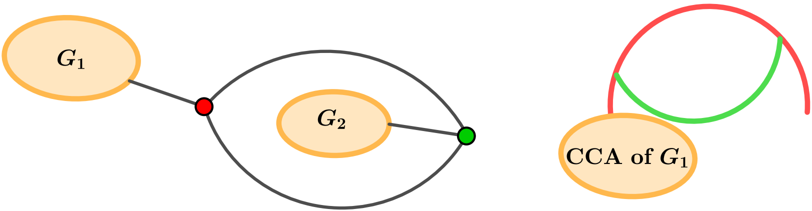

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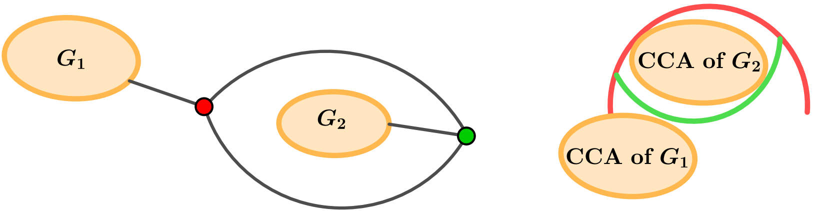

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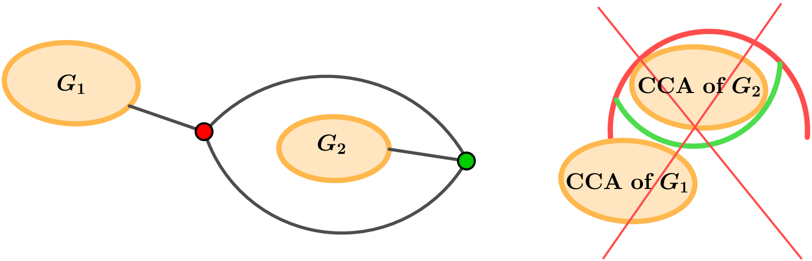

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- Md. Jawaherul Alam, David Eppstein, Michael Kaufmann, Stephen G. Kobourov, Sergey Pupyrev, Andr Schulz, and Torsten Ueckerdt, Contact graphs of circular arcs, Algorithms and data structures, Lecture Notes in Comput. Sci., vol. 9214, Springer, Cham, 2015, pp. 113.