Planar Graphs - Abstract

This presentation is focused on planar graphs. Its aim is to familiarize the audience with basic terms, concepts and theorems of planar graph theory, with algorithms that are used in it and with ways this knowledge can be used in practice. Concepts are explained on examples that are illustrated on sample graphs. The presentation is divided into following chapters: Planarity and Duality, Edge Addition Planarity Testing Algorithm, Planarity Testing Based on PC-Trees, Graph Drawing.

The first chapter explains graph theory concepts such as planarity and duality. It establishes properties of planar and dual graphs and their connection to electrical circuits. The transformation from a planar graph to its dual variant is shown. Planar graphs can be defined in a number of ways. Different characterizations were given by Kuratowski, Warner, Harary and Tutte, and MacLane. This chapter mentions and compares some of these approaches.

The second chapter explains the planar graph embedding problem which attempts to transform a graph so that no two edges intersect each other. An edge addition planarity algorithm is described that constructs a combinatorial planar embedding by adding edges to a graph in such a way that its planarity is preserved. Any planar graph can be constructed using this method and failure to add all edges means that the input graph is not planar.

The third chapter describes different ways to test whether a given graph is planar. A detailed look on one of these liner-time methods based on PC-Trees follows.

The last chapter shows different ways how a planar graph can be drawn. It discusses methods used to create these diagrams, including established labels and procedures.