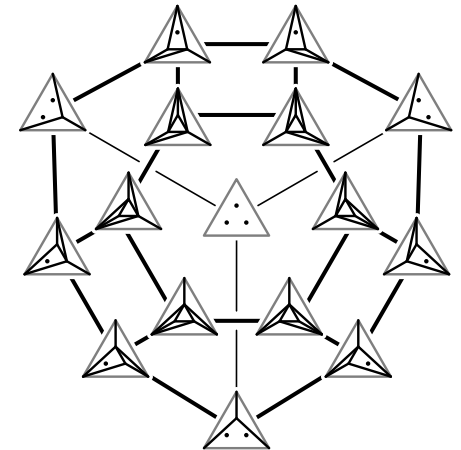
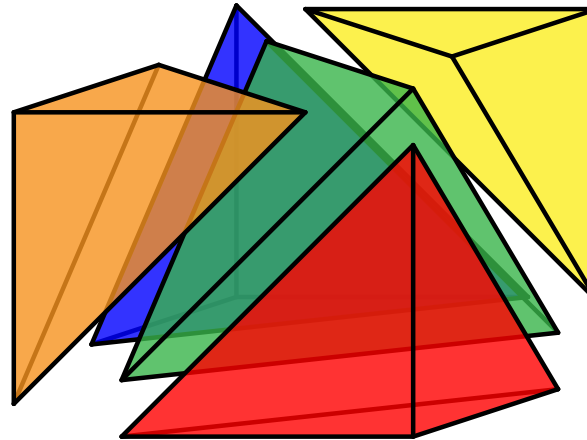
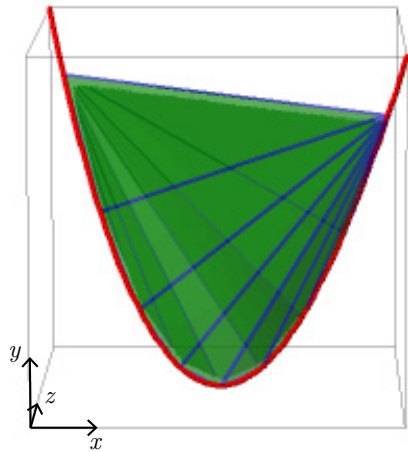
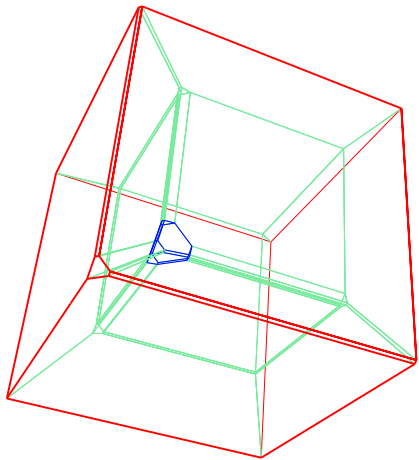


MPRI 2-38-1. Algorithms and combinatorics for geometric graphs



V. PILAUD
Fridays 12:45 – 15:45

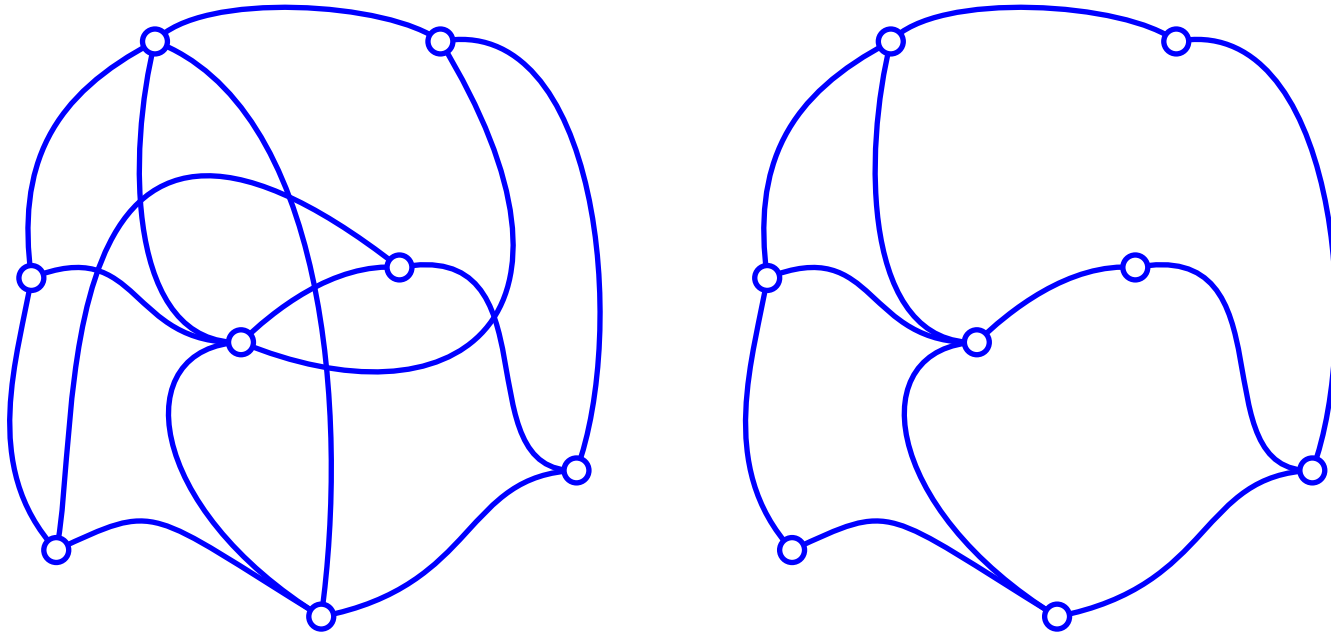
slides available at: <http://www.lix.polytechnique.fr/~pilaud/enseignement/MPRI/MPRI-2-38-1-VP-0.pdf>

Course notes available at: <https://www.lix.polytechnique.fr/~pilaud/enseignement/MPRI/notesCoursMPRI22.pdf>

PLANAR GRAPHS

Planar graphs are very special:

- combinatorially (few edges, Euler relation, 4-colorable, ...),
- algorithmically (use planar structure to design more efficient algorithms).



The course reviews planar graphs and explores properties of geometric graphs

ALGORITHMS AND COMBINATORICS FOR GEOMETRIC GRAPHS

1. Graphs drawn in the plane (LCA)

- basics (combinatorial representations, topology, duality, Euler's formula)
- embeddings (Tutte barycentric theorem, Schnyder woods)
- algorithms (planarity testing, efficient algorithms for planar graphs)
- crossing numbers for graphs (topological and geometrical versions)

2. Polytopes and triangulations (VP)

- basics on polytopes (faces, face numbers, extreme polytopes, ...)
- triangulations and secondary polytopes
- permutahedra and associahedra

3. Graphs on surfaces (AdM)

- classification theorem for surfaces up to homeomorphism
- topological algorithms for graphs on surfaces: shortest loops and systems of loops
- homotopy testing, and perhaps a few more things if time allows

PROGRAM

- Sept 16. Introduction to geometric and planar graphs (VP)
- Sept 23. Planarity testing, Tutte embedding, efficient algorithms (LCA)
- Sept 30. Introduction to polytopes (VP)
- Oct 7. Face numbers and extremal polytopes (VP)
- Oct 14. Triangulations and secondary polytopes (VP)
- Oct 21. Schnyder woods (LCA)
- Oct 28. Surface classification, decomposing surfaces (AdM)
- Nov 4. Algorithms for graphs on surfaces (AdM)
- Nov 25 or Dec 2. Exam

PROGRAM

All course material is available here:

<http://www.lix.polytechnique.fr/~pilaud/enseignement/MPRI/>

All informations about the course are available here:

<https://wikimpri.dptinfo.ens-cachan.fr/doku.php?id=cours:c-2-38-1>