More precisely, the approach is multifaceted. First it is necessary to develop an algorithm in the spirit of rounding meshes in 3D. In a nutshell, the goal of this PhD is to propose a certified and practically efficient algorithm and an implementation for rounding meshes in 3D.

Principales activités

Project description

In a nutshell, the goal of this PhD is to propose a certified and practically efficient algorithm and an implementation for rounding meshes in 3D. More precisely, the approach is multifaceted. First it is necessary to develop an algorithm in the spirit of rounding meshes in 3D.
of the recent theoretical solution [2] but which can be implemented in a reasonable way. Furthermore, such algorithm will need to be reasonably efficient in practice, ideally with an observed complexity on real data close to $O(n^{\sqrt{n}})$. Ideas have been raised for this problem in Valque Master thesis [17] but they still need to be explored.

Second, the candidate will have to develop an algorithm that can round efficiently the vertices everywhere it does not cause topological conflicts. This problem is quite clearly tractable although it is more subtle than it seems at first sight.

Furthermore, the two above algorithms will have to be compatible and intertwined. Ideally we aim at a solution that would round naively everywhere it does not cause troubles and that would use the heavy-hammer approach in hopefully small boxes where rounding is difficult. This goal might be out of reach but a weaker goal, still hopefully efficiently, is to apply the heavy-hammer scheme in hopefully reasonable small slabs (instead of boxes).

The goal is also to implement these algorithms in CGAL [16], the reference library for geometric algorithms. This is especially interesting because CGAL Factory (the start-up that distributes CGAL) has requests from companies for such software and this would be a good way for distributing it widely and swiftly.

Another facet of the work will be to study the complexity of these algorithms under some reasonable probabilistic model. Indeed, on one hand, the (worst-case) bound of $O(n^{15})$ in [2] seems difficult to substantially improve and on the other hand, there are some evidences that a practical complexity in $O(n^{\sqrt{n}})$ makes sense. The gap is thus very large. One goal is to study the complexity considering some reasonable distributions of vertices on surfaces. A first step has been considered in this direction in [2] showing a complexity of $O(n^{15})$ under some set of hypotheses but the gap still remains large.

The thesis will include both theoretical work and programming in the well-recognized C++ CGAL library, which will open up many opportunities for the PhD student in both academia and industry.

References


Language

French or English.

Other appreciated qualifications

C++, CGAL

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération


Monthly salary after taxes: around 1596,05€ for 1st and 2nd year. 1678,99€ for 3rd year.