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CGAL periodic volume mesh generator

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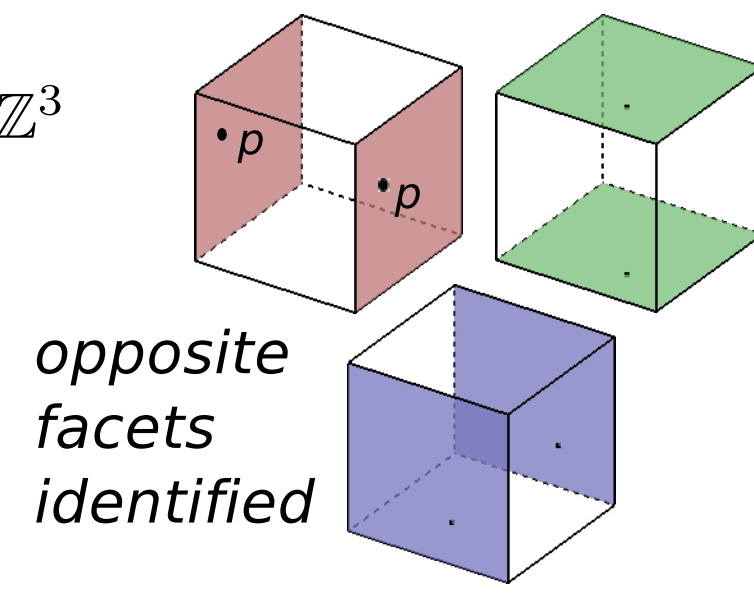
Submitted on 9 Dec 2014

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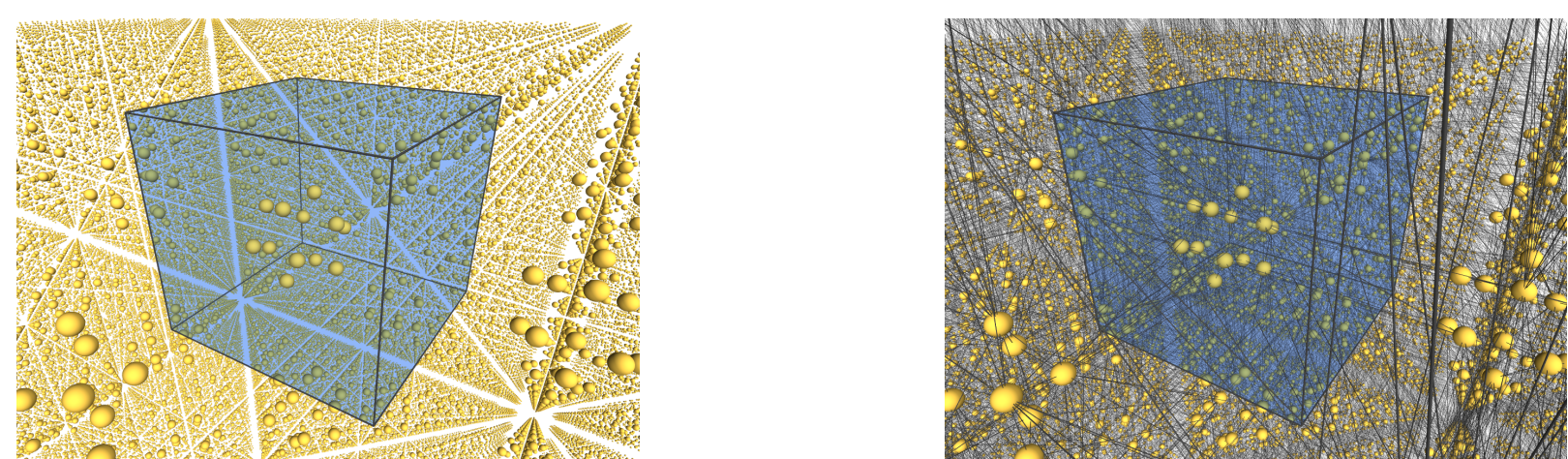
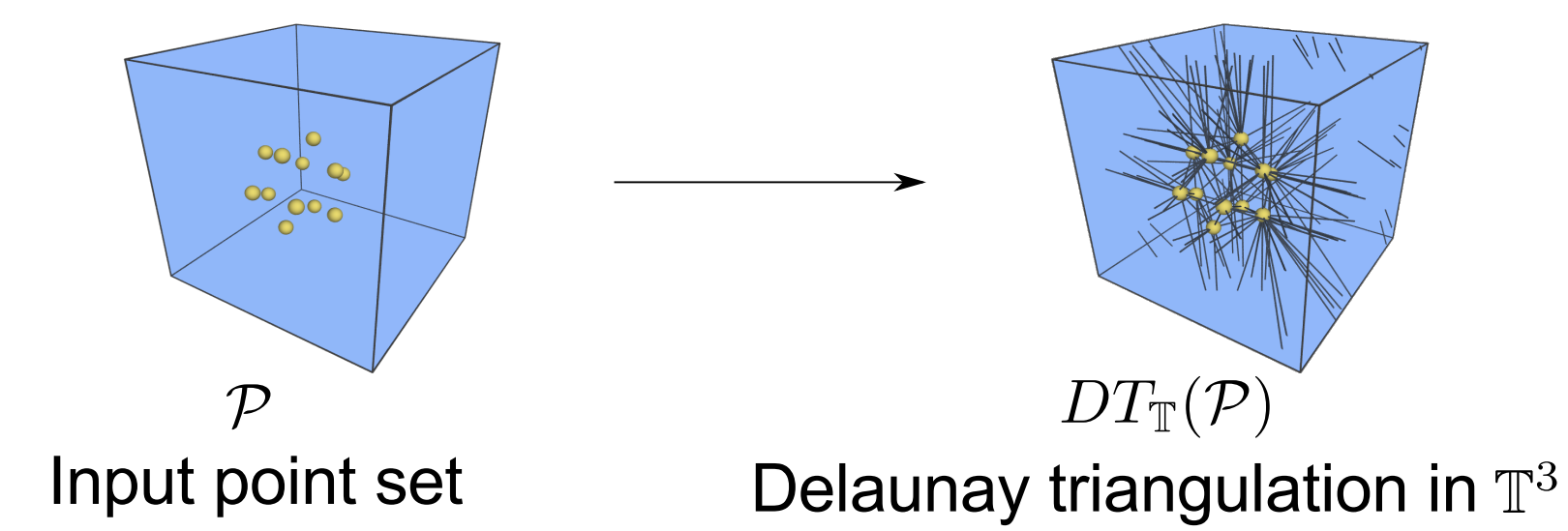
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Periodic Delaunay triangulation [CT09]

Flat torus : $\mathbb{T}^3 = \mathbb{R}^3 / \mathbb{Z}^3$



A finite computation for an infinite structure



Triangulation

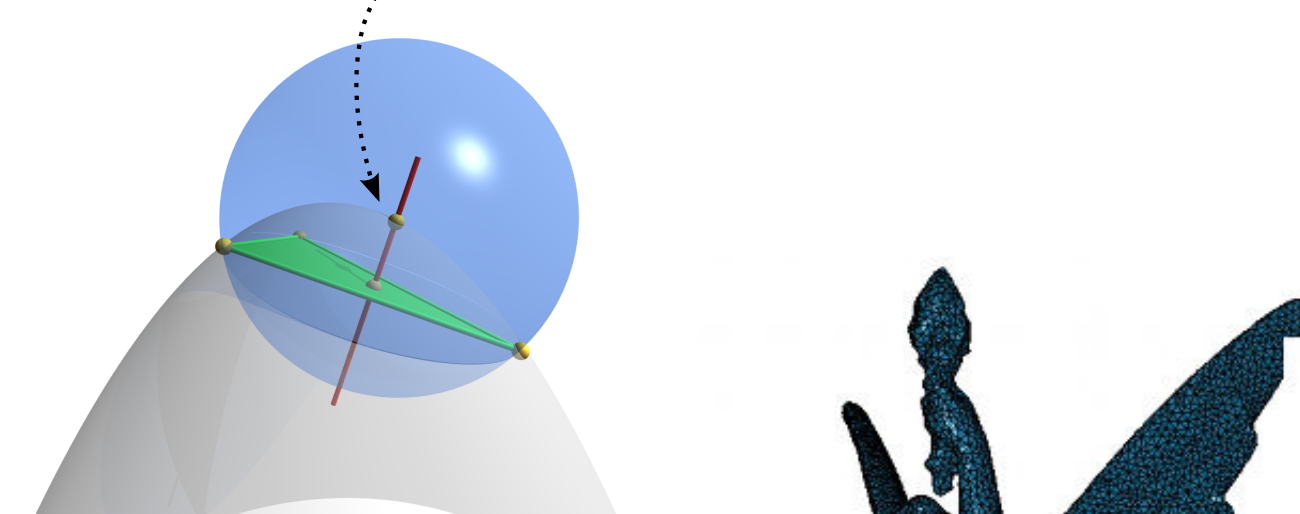
Volume mesh [RY07]

Delaunay Refinement

Criteria

- Shape
- Size
- Distance

```
while (is_bad(simplex))
  refine(simplex);
```

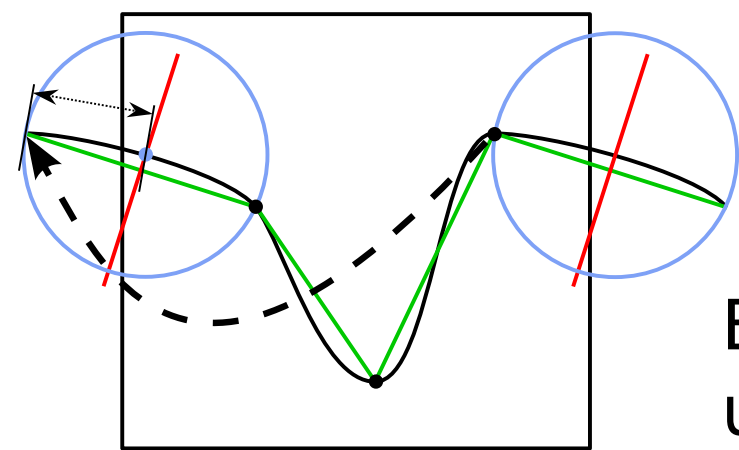


Restricted Delaunay
Triangulation
(case of a facet)

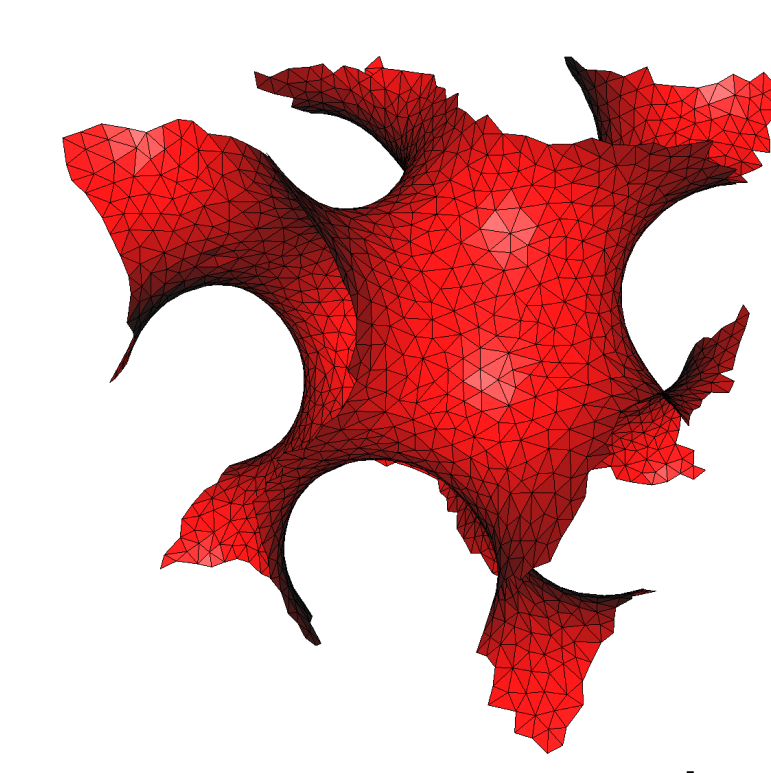


Criteria

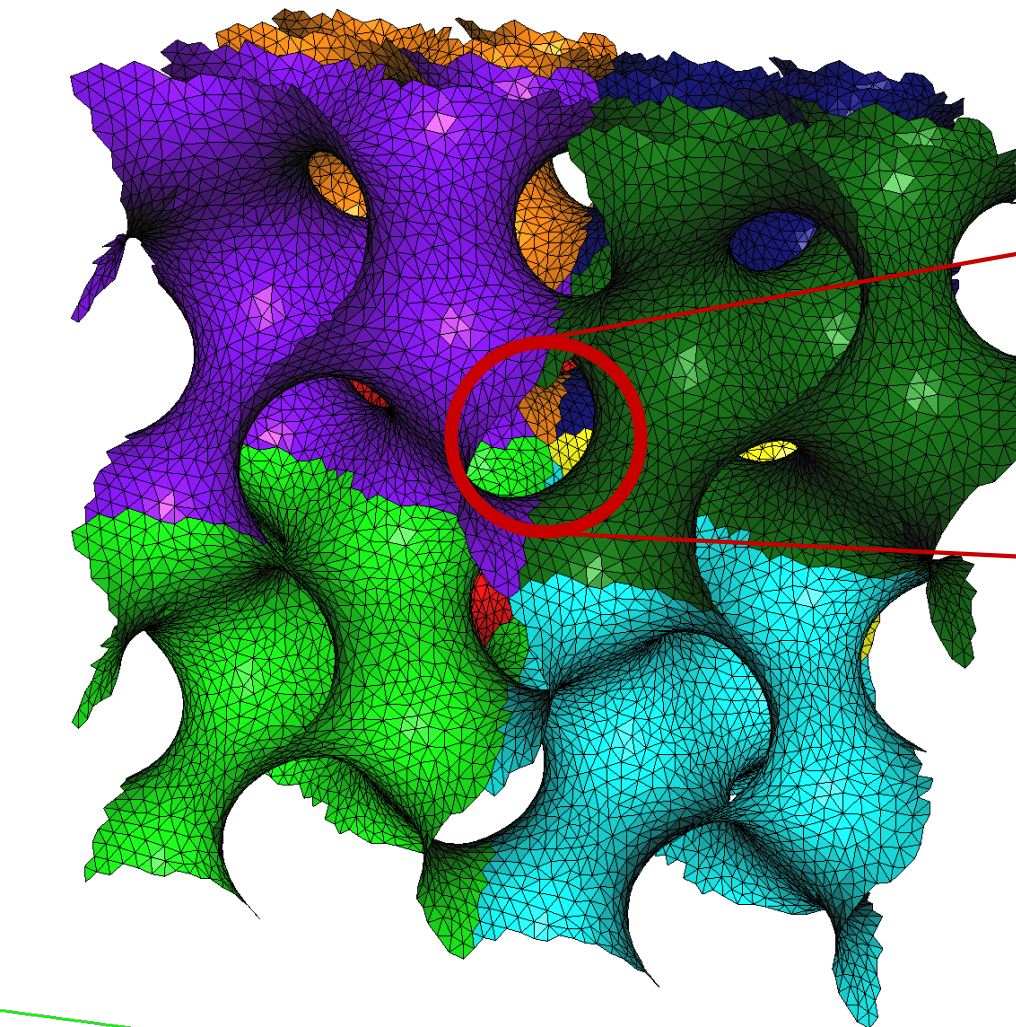
Periodic refinement criteria



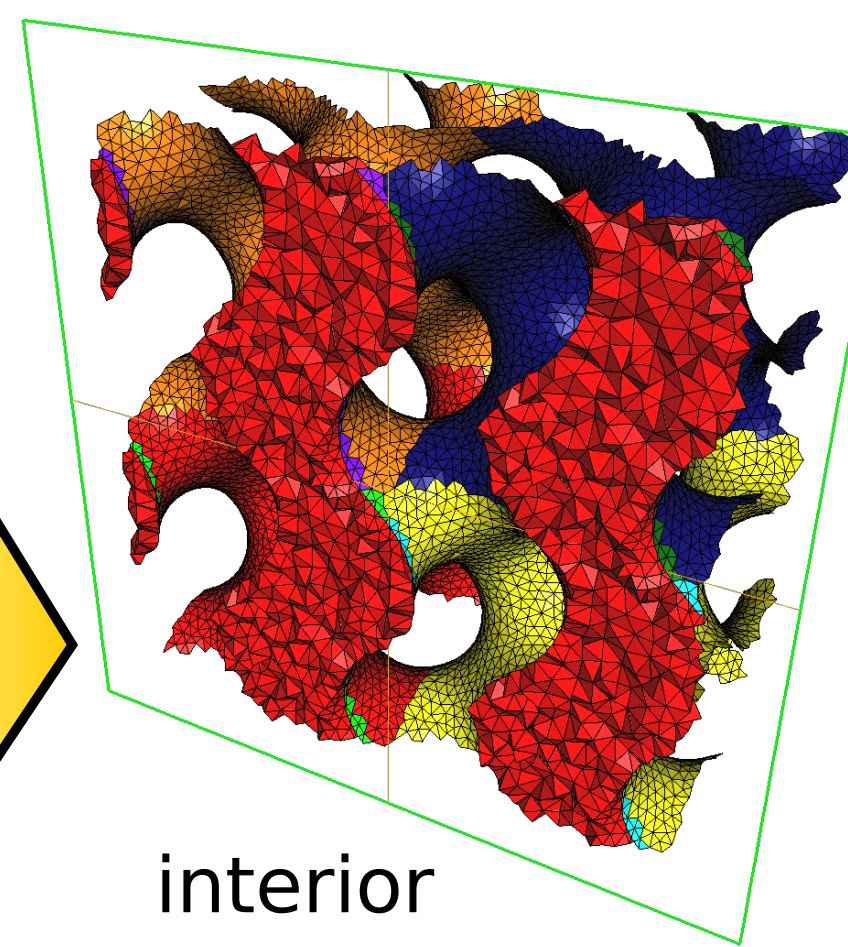
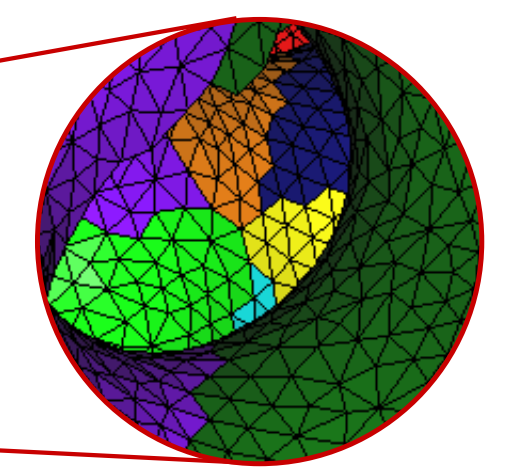
Evaluate the simplex quality using translated vertices



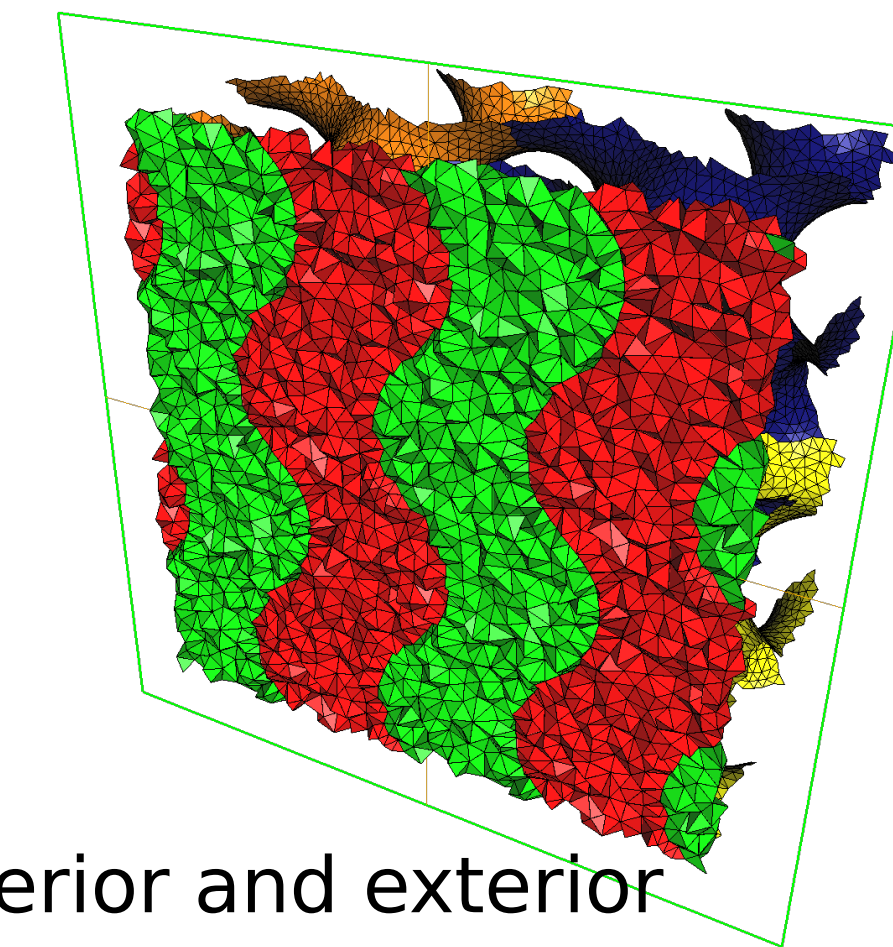
one copy computed



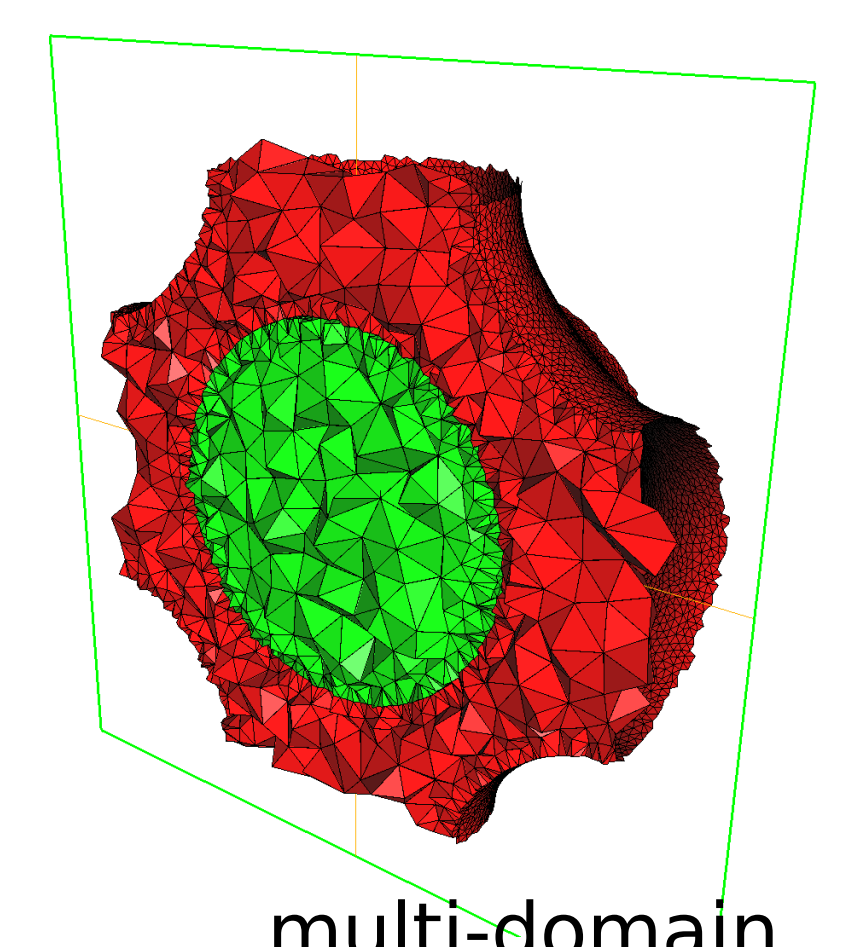
periodic copies fit together



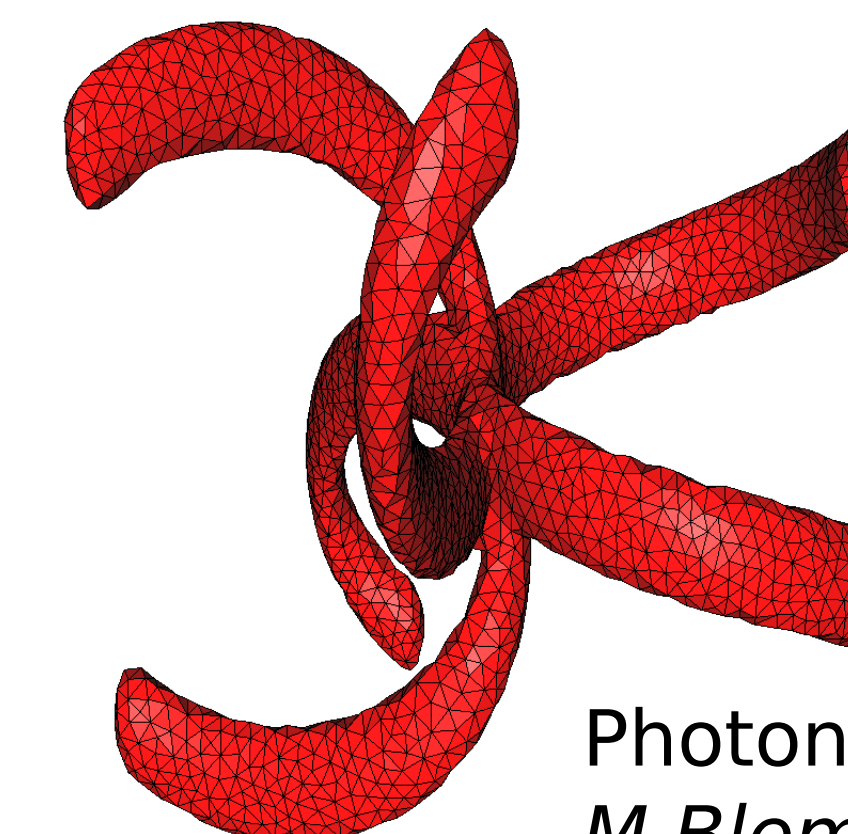
interior



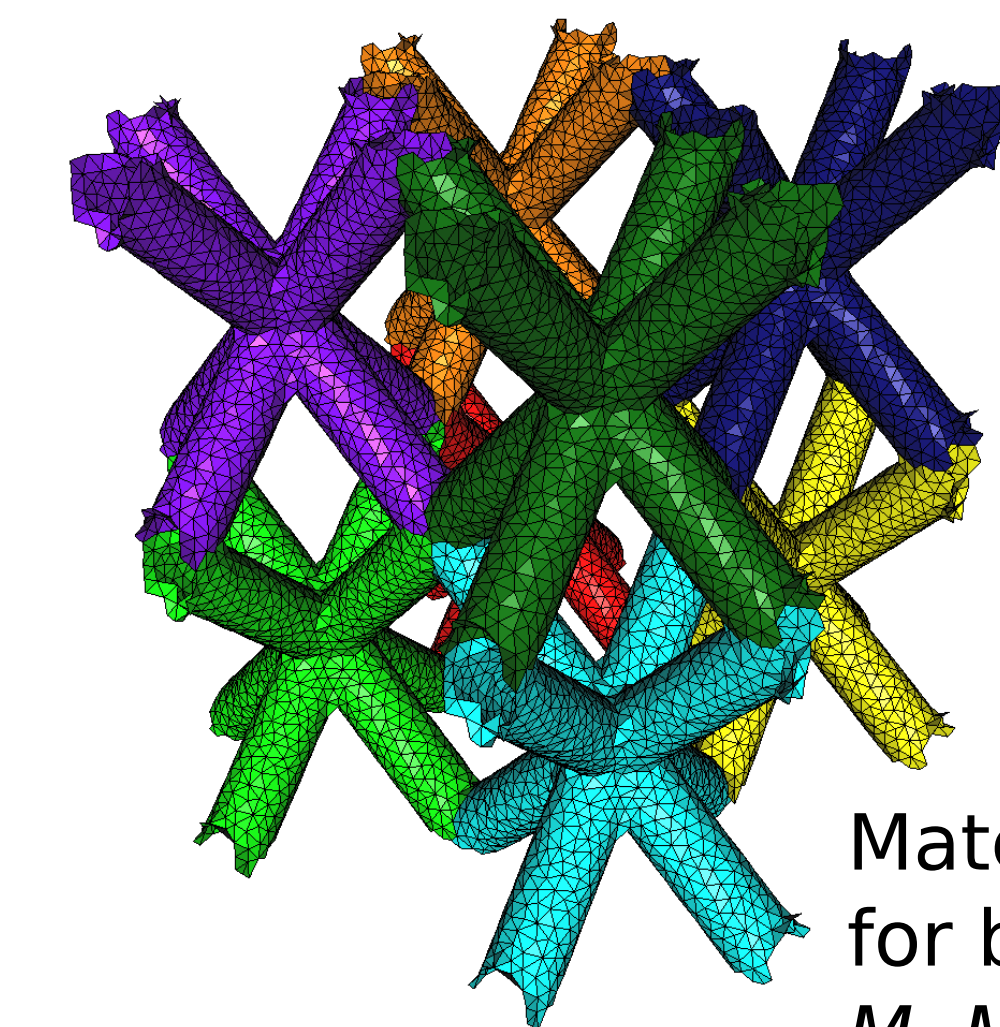
interior and exterior



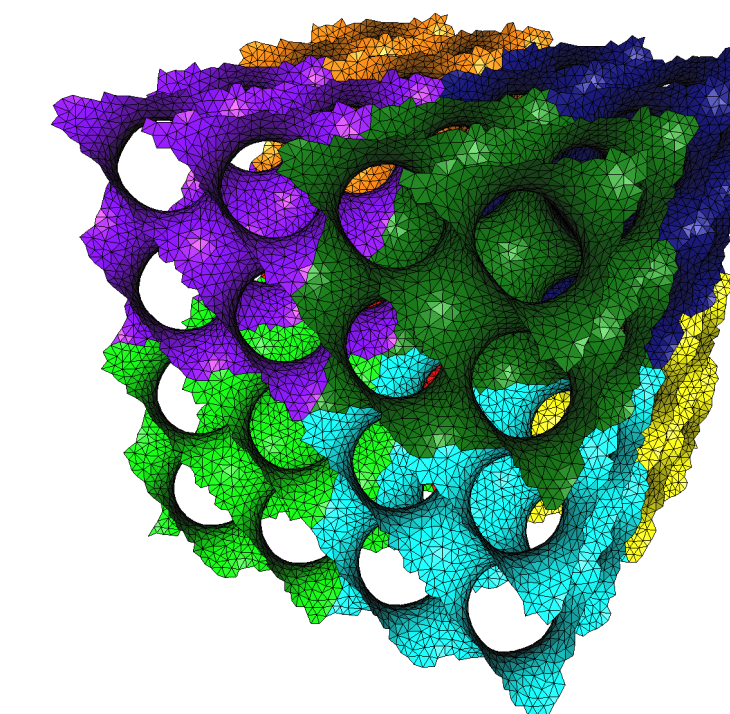
multi-domain and sizing field



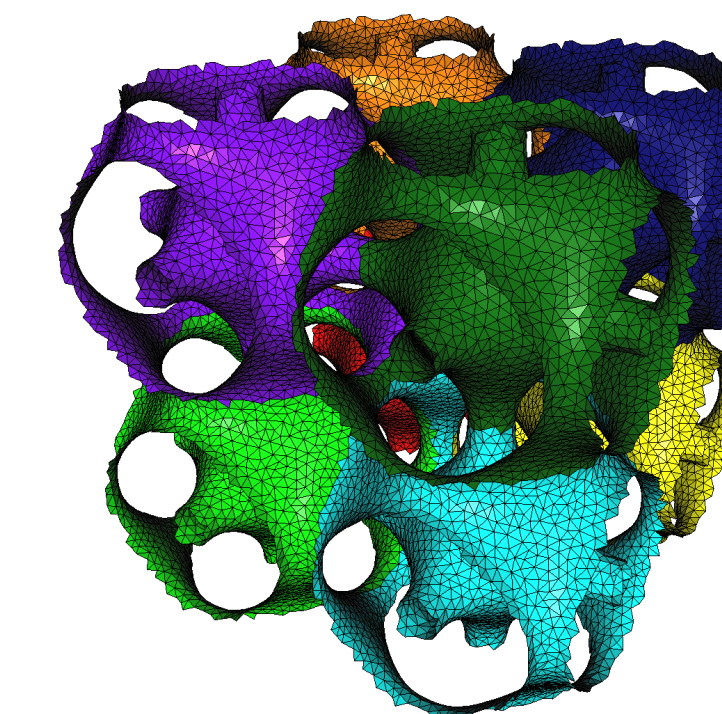
Photonic crystal
M.Blome
Zuse Institute Berlin



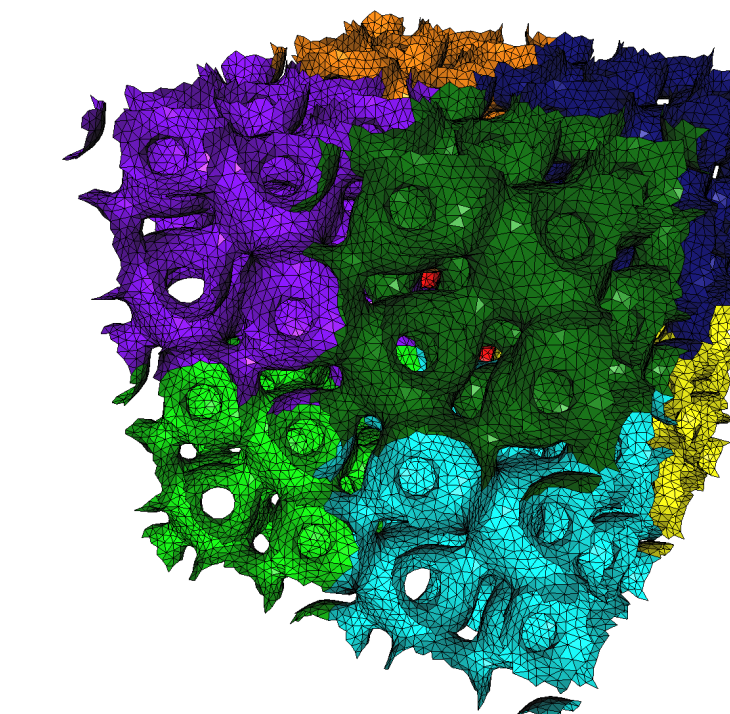
Material for bone scaffolding
M. Moesen
K.U. Leuven



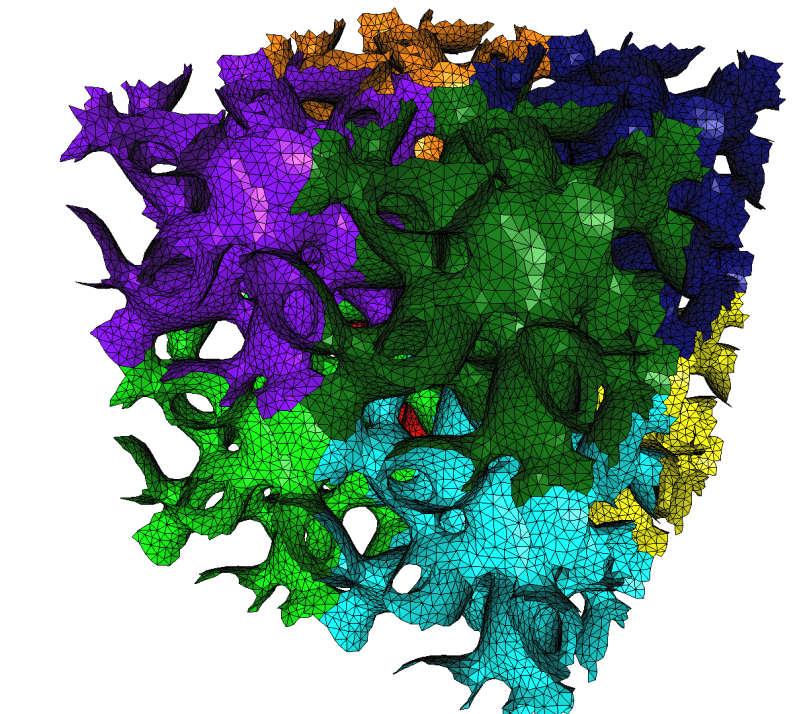
Diamond



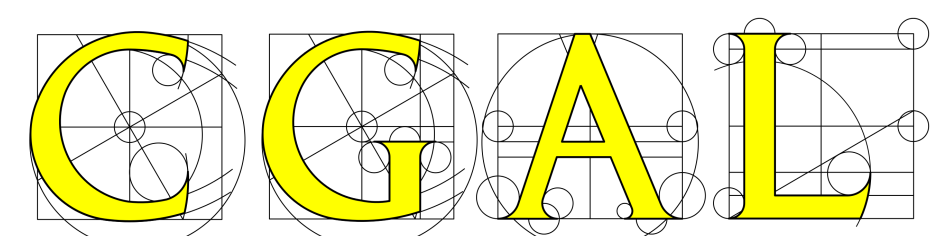
Double p



D prime



Lidinoid



www.cgal.org



Computational Geometry Algorithms Library

- Open source
- Templated C++ (genericity)
- Robust, Efficient
- Cross-platform
- Academic and Industrial users
- Dual License (GPL & commercial)
- Large variety of packages

In progress

- Meshes on sphere
- Hyperbolic meshes
- Anisotropic meshes
- ...



Manuel Caroli and Monique Teillaud.
3D Periodic Triangulations

Pierre Alliez, Clément Jamin, Laurent Rineau, Stéphane Tayeb, Jane Tourmois, Mariette Yvinec
3D Mesh Generation

References

- [CT09] Manuel Caroli and Monique Teillaud. Computing 3D Periodic Triangulations. In *Proc. 17th ESA*, LNCS 5757, pp 37-48, 2009.
- [RY07] Laurent Rineau and Mariette Yvinec. A generic software design for Delaunay refinement meshing. *Comput. Geom. Theory Appl.*, 38:100-110, 2007.
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Acknowledgments

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