



CGAL periodic volume mesh generator

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► To cite this version:

| Aymeric Pellé, Monique Teillaud. CGAL periodic volume mesh generator. International Meshing Roundtable, Oct 2014, Londres, United Kingdom. , 2014. hal-01089980

HAL Id: hal-01089980

<https://inria.hal.science/hal-01089980>

Submitted on 9 Dec 2014

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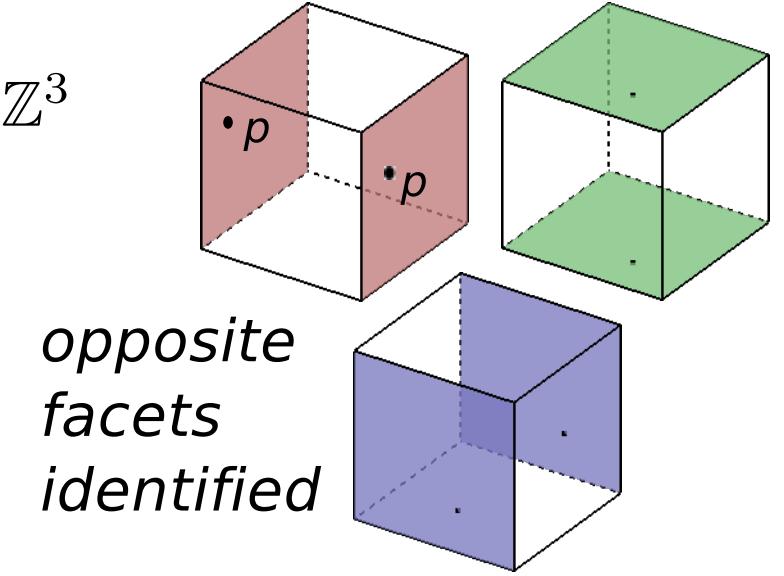
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CGAL periodic volume mesh generator

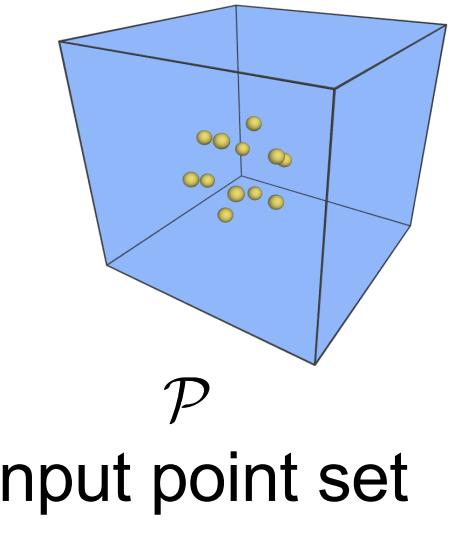
Aymeric Pellé and Monique Teillaud

Periodic Delaunay triangulation [CT09]

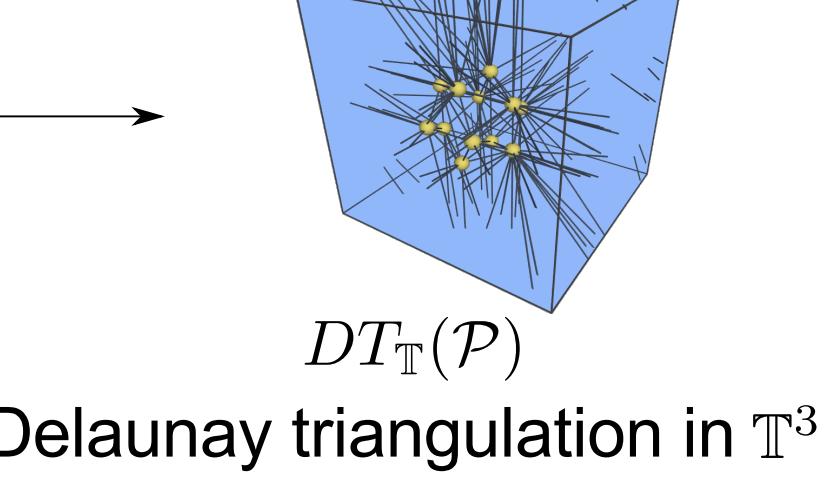
Flat torus : $\mathbb{T}^3 = \mathbb{R}^3 / \mathbb{Z}^3$



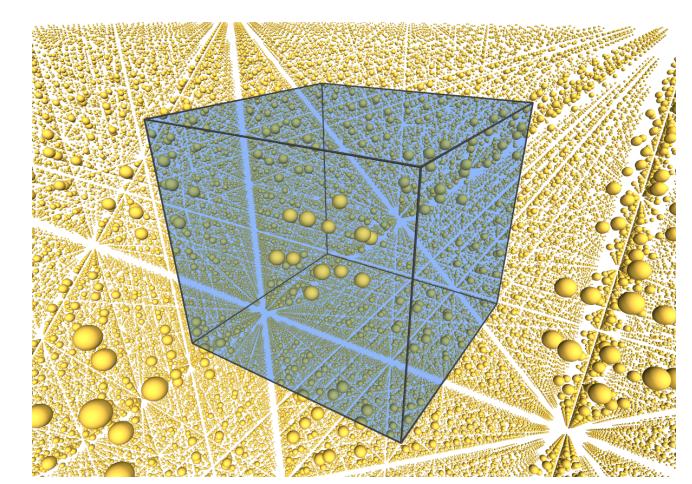
A finite computation for an *infinite* structure



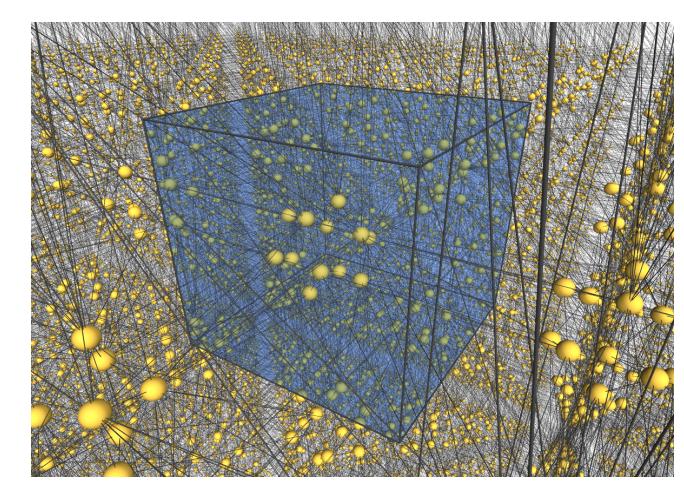
P
Input point set



$DT(\mathcal{P})$
Delaunay triangulation in \mathbb{T}^3



$\mathcal{P} + \mathbb{Z}^3$
Infinite point set



$DT(\mathcal{P} + \mathbb{Z}^3)$
Infinite Delaunay triangulation

Volume mesh [RY07]

Delaunay Refinement

Criteria

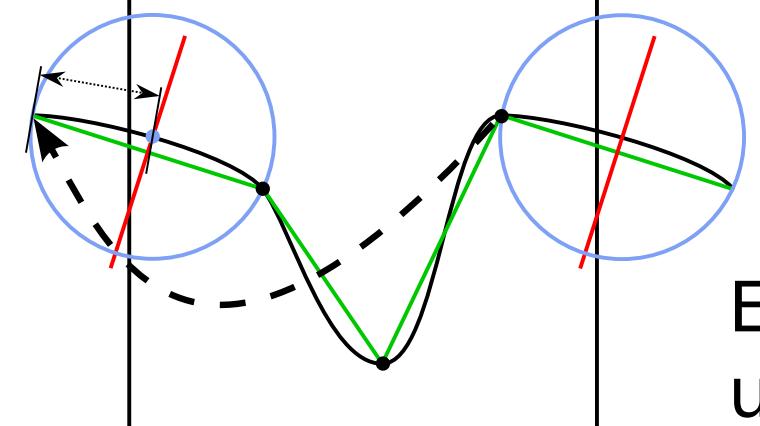
- Shape
- Size
- Distance

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

Restricted Delaunay
Triangulation
(case of a facet)

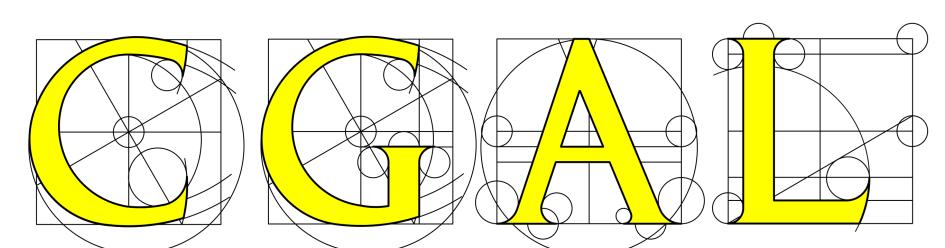


Periodic refinement criteria



Evaluate the simplex quality using translated vertices

Criteria



www.cgal.org



Computational Geometry Algorithms Library

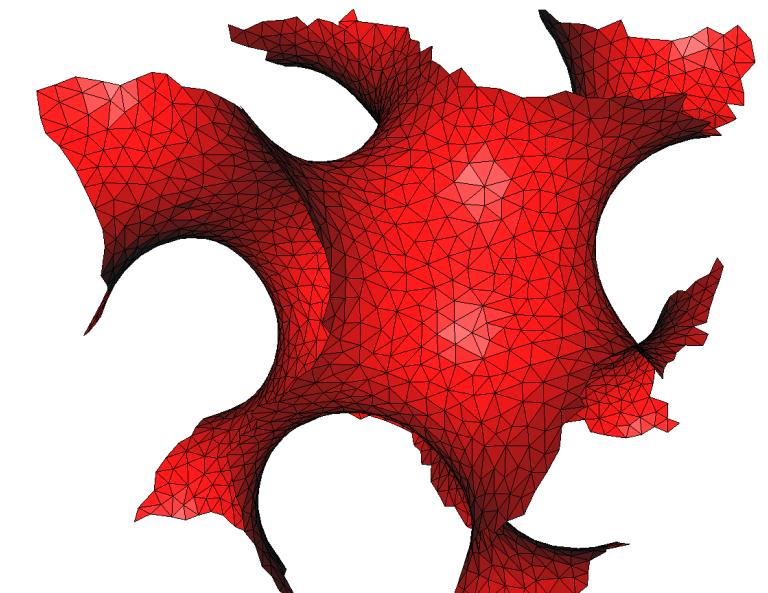
- Open source
- Tempered C++ (genericity)
- Robust, Efficient
- Cross-platform
- Academic and Industrial users
- Dual License (GPL & commercial)
- Large variety of packages

In progress

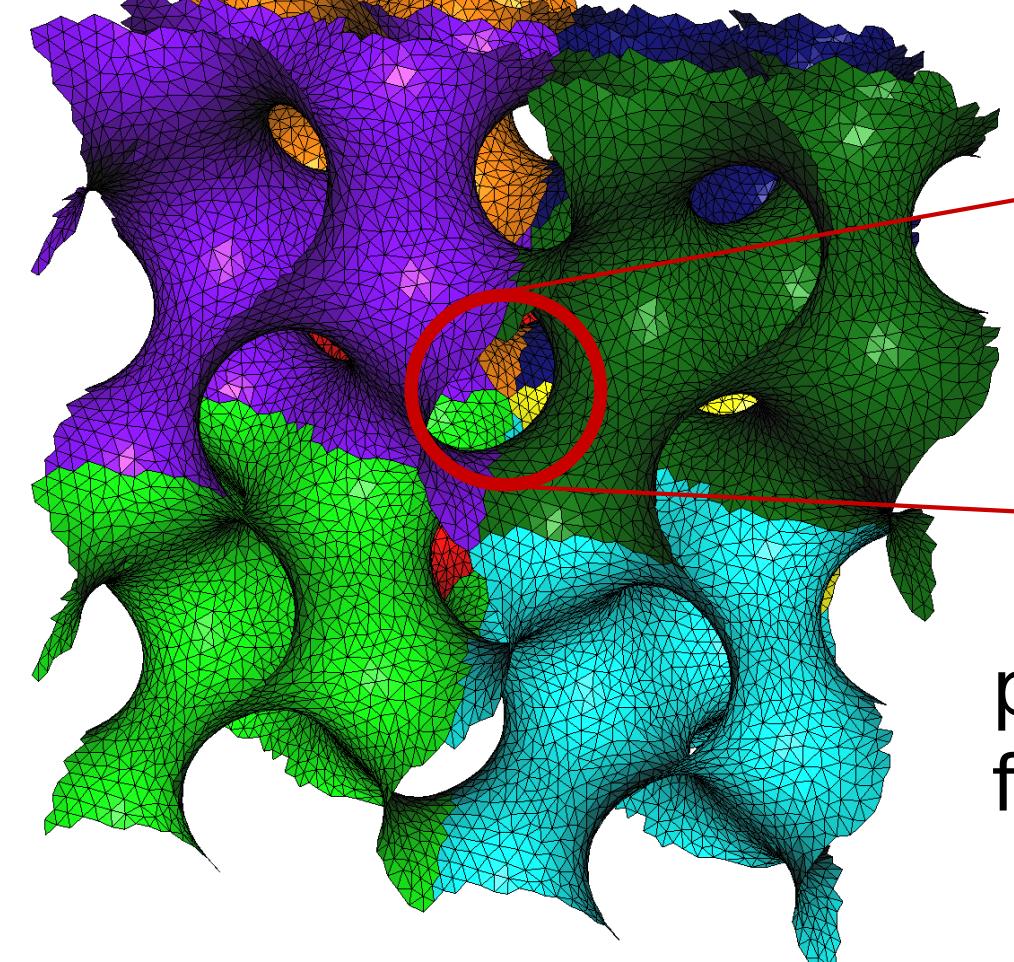
- Meshes on sphere
- Hyperbolic meshes
- Anisotropic meshes
- ...



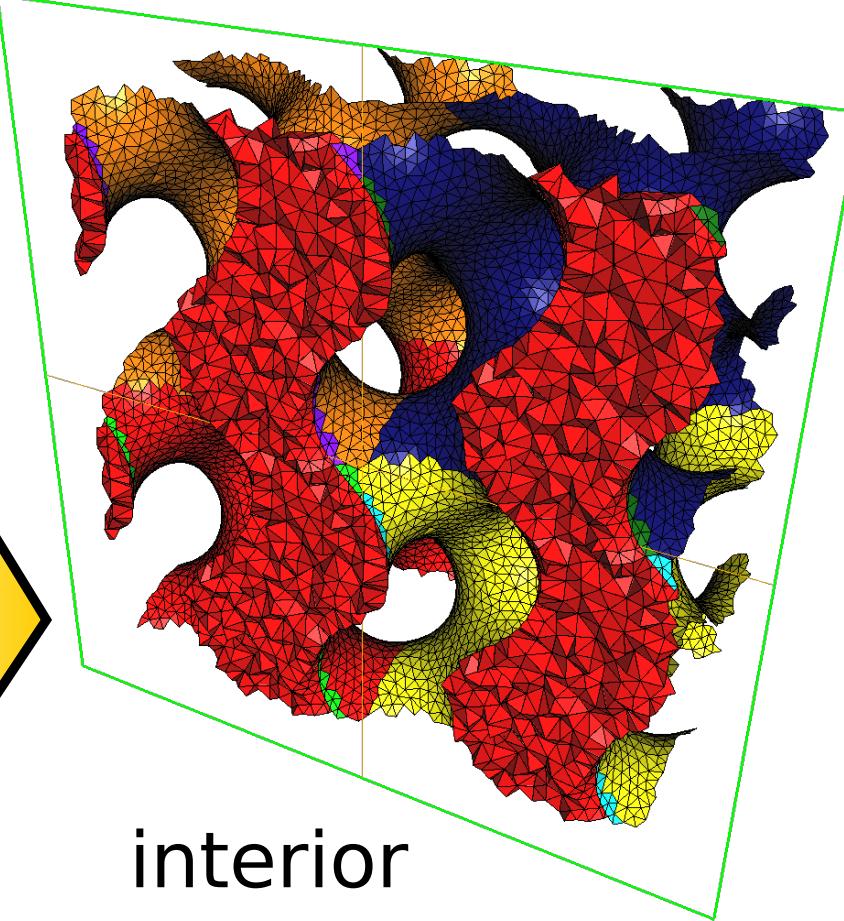
Manuel Caroli and Monique Teillaud.
3D Periodic Triangulations
Pierre Alliez, Clément Jamin, Laurent Rineau, Stéphane Tayeb, Jane Tournois, Mariette Yvinec
3D Mesh Generation



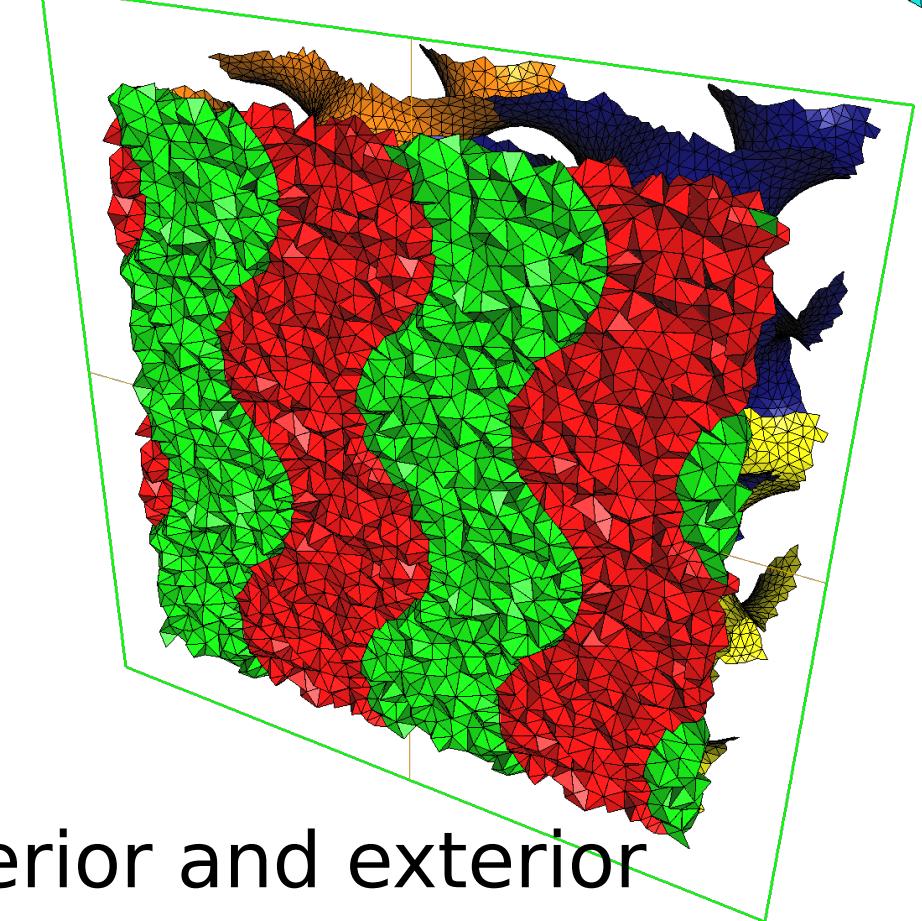
one copy computed



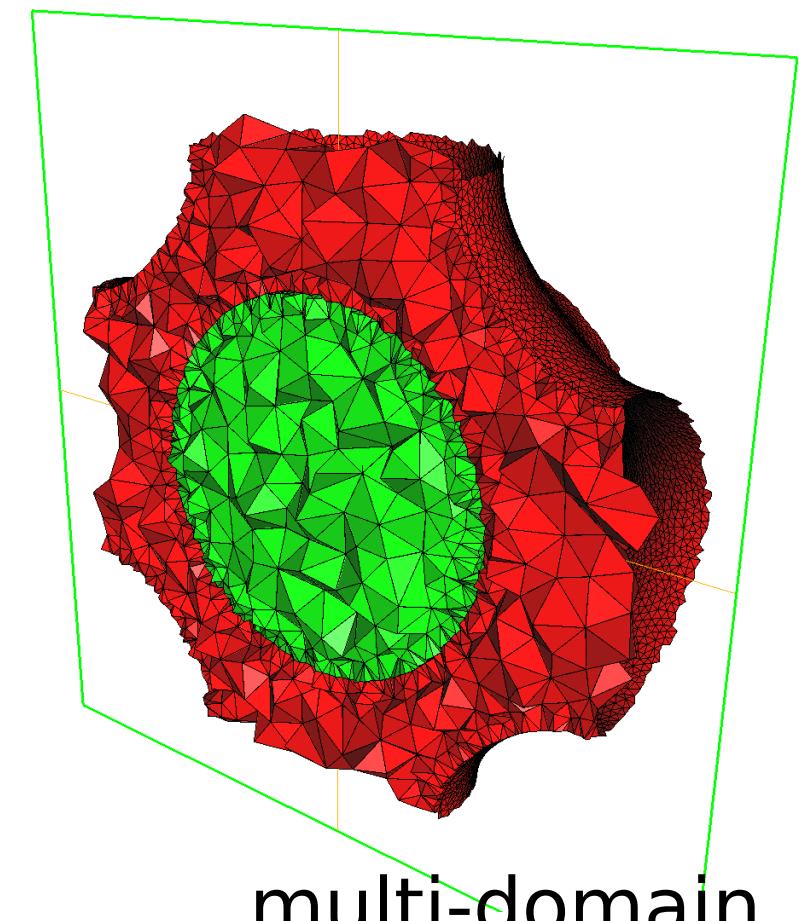
periodic copies fit together



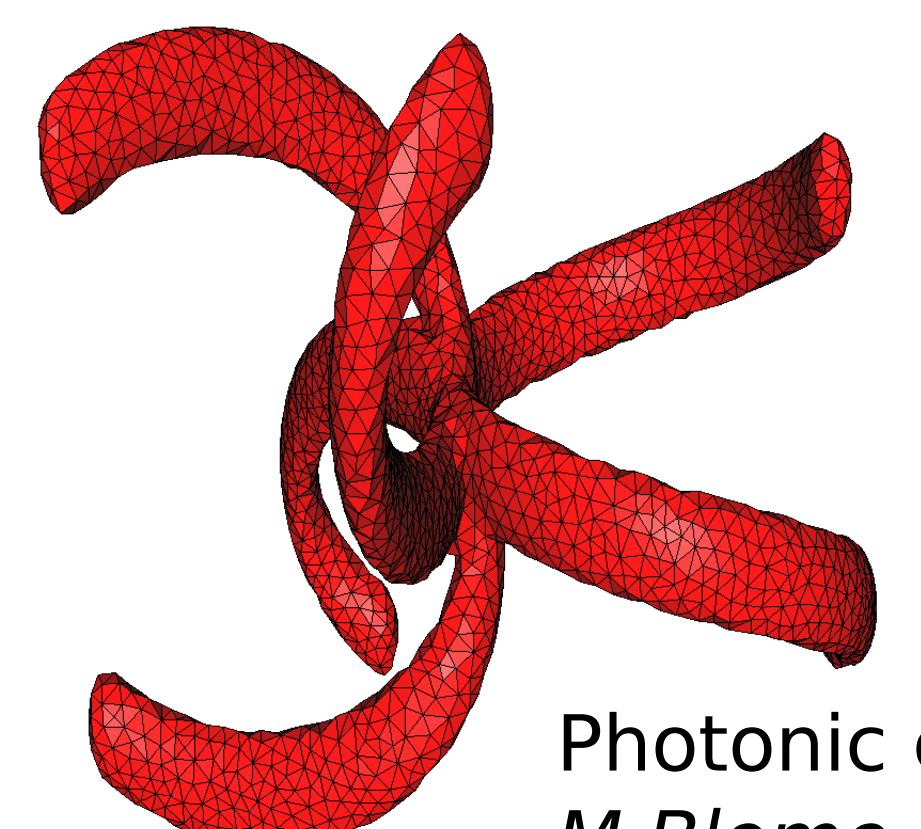
interior



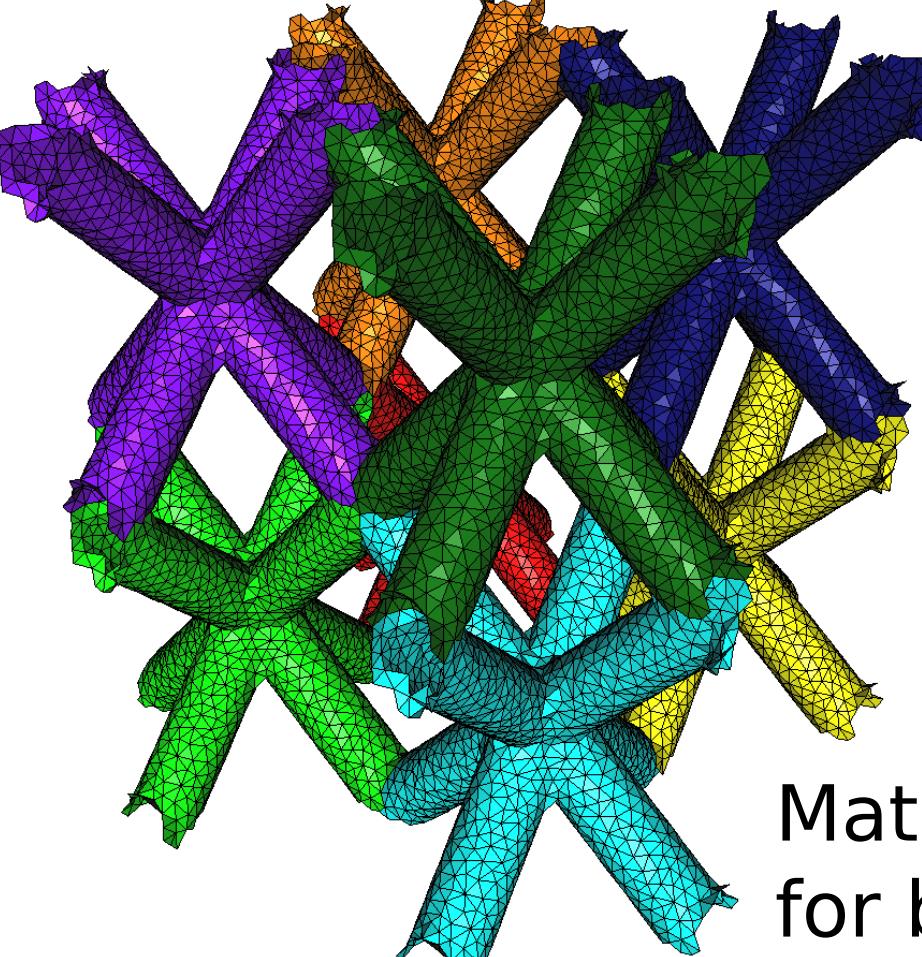
interior and exterior



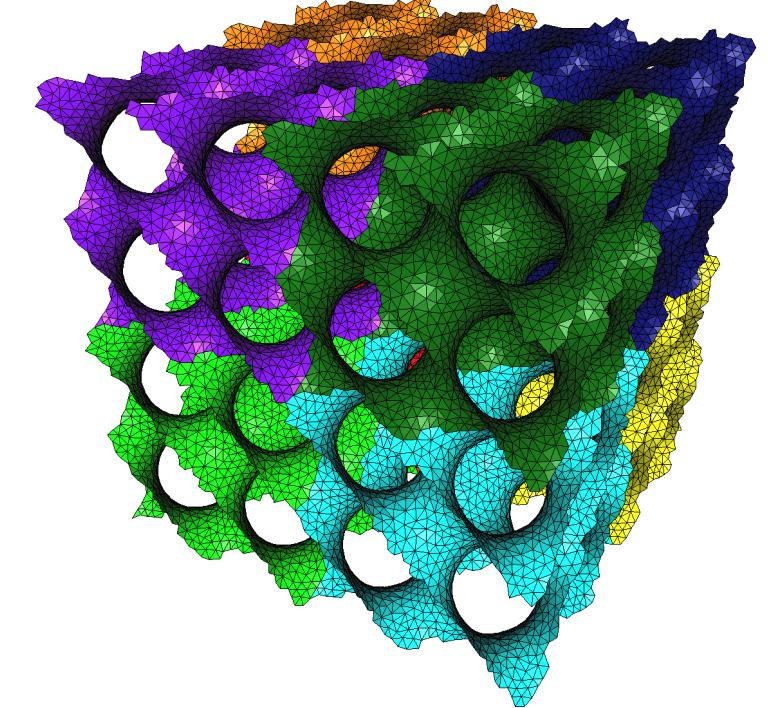
multi-domain and sizing field



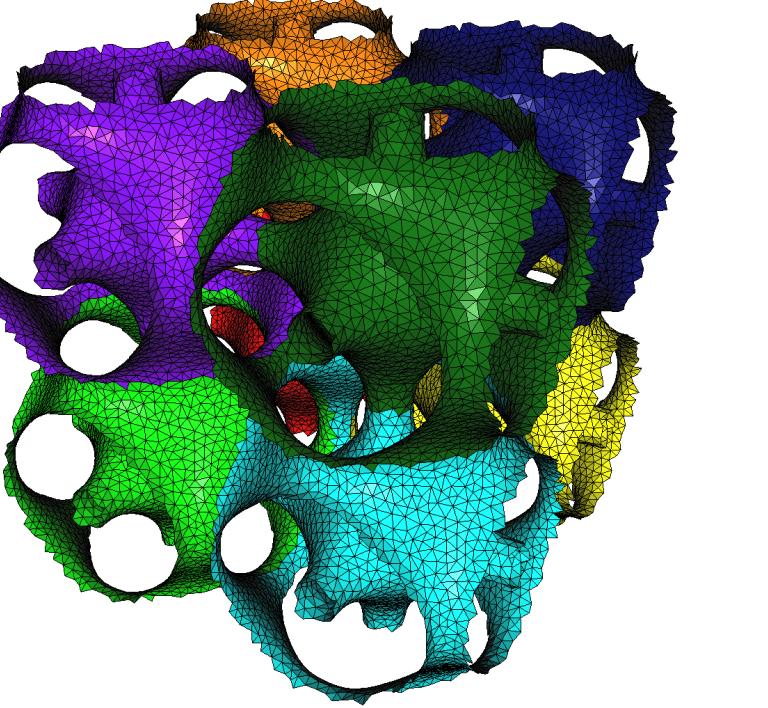
Photonic crystal
M. Blome
Zuse Institute Berlin



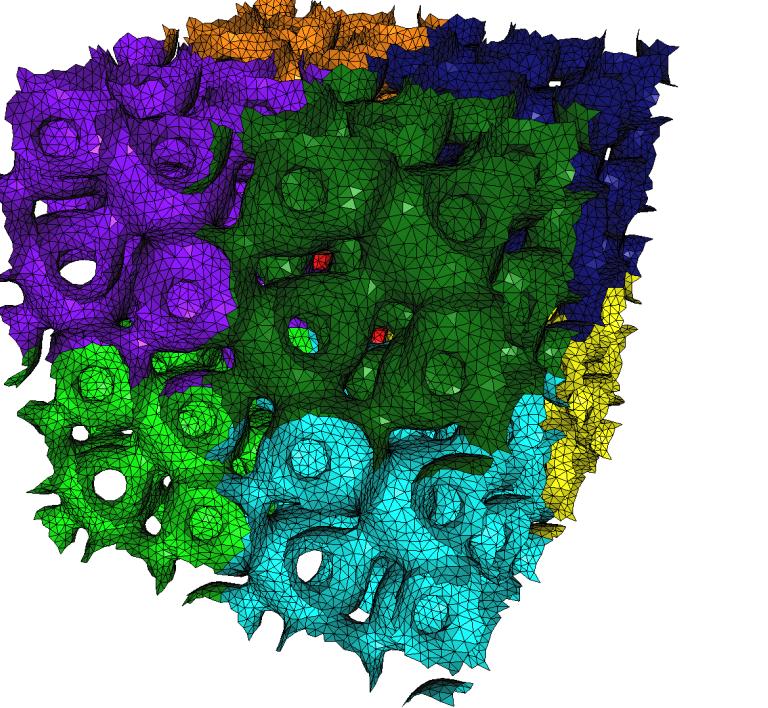
Material for bone scaffolding
M. Moesen
K.U. Leuven



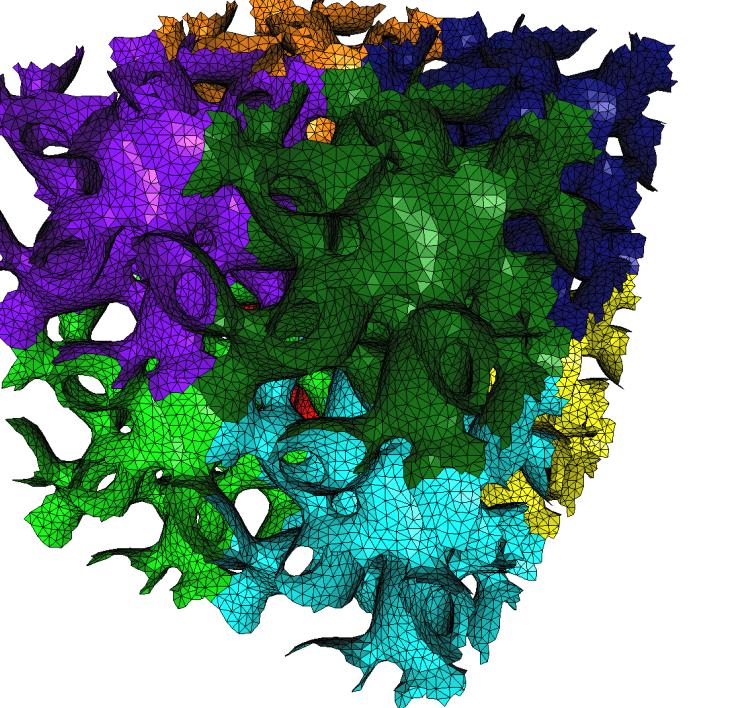
Diamond



Double p



D prime



Lidinoid

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.

Meshing 3D Domains Bounded by Piecewise Smooth Surfaces. In Proc. IMR, pp 443-460, 2007.

Acknowledgments

The authors wish to thank Manuel Caroli and Mikhail Bogdanov for their contribution.
Screenshots have been made with Medit.
This work is partially sponsored by the INRIA Technological Development Action OrbiCGAL
<http://www-sop.inria.fr/members/Monique.Teillaud/ADT-OrbiCGAL/>