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Nested Cages

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Many tasks in geometry processing and physical simulation benefit from multiresolution hierarchies. One important characteristic across a variety of applications is that coarser layers strictly encage finer layers, nesting one another. Existing techniques such as surface mesh decimation, voxelization or contouring distance level sets do not provide sufficient control over the quality of the output surfaces while maintaining strict nesting. We propose a solution that enables use of application-specific decimation and quality metrics. The method constructs each next-coarsest level of the hierarchy, using a sequence of decimation, flow and contact-aware optimization steps. From coarse to fine, each layer then fully encages the next while retaining a snug fit. The method is applicable to a wide variety of shapes of complex geometry and topology. We demonstrate the effectiveness of our nested cages not only for multigrid solvers, but also for conservative collision detection, domain discretization for elastic simulation and cage-based geometric modeling.

Biography

Leonardo Sacht is an Adjunct Professor at Federal University of Santa Catarina (UFSC) in Florianopolis, Brazil. He received Bachelor degree in Mathematics and Scientific Computing from UFSC in 2008 and MSc and DSc degrees in Mathematics from the Brazilian Institute for Pure and Applied Mathematics (IMPA) in 2010 and 2014, respectively. He also spent one year between 2012 and 2013, as a visiting student at ETH Zurich, Switzerland. He recently published papers on journals such as ACM Transactions on Graphics, Journal of Real-Time Image Processing and IEEE Transactions on Image Processing.

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