On some applications of grids and meshes

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Abstract: *Meshes and grids are used in many modeling problems: reconstruction of 3D surfaces, problems from physics, finite element method. Optimizing the mesh or grid construction is a challenge problem. The aim of this lecture is to present a triangular mesh optimization for approximation of 3D scanned surface and a multi-resolution method for creation of a grid applied to an explicit finite difference scheme.*

Reconstruction of 3D surface that is given by a set of points that lie near that surface can be performed by construction of a triangular mesh. Accuracy of a mesh obtained in this way can be unsatisfactory. That gives a motivation for transformation of the mesh. Criteria for mesh optimization are often contradictory: it is desirable to have resulting mesh as close as possible to the original points, but it is also desirable to have manageable mesh with limited number of elements. Energy function is introduced that balances these requirements and also solves some convergence problems. Mesh obtained in this way is smaller, more precise and it represents initial surface with more plausibility The method is illustrated for 3D representation of a tore, a sphere and a human hand

The algorithm we propose for multi –resolution grid creation is optimized for the use in program application. The algorithm is illustrated with the numerical simulation of the propagation of a light beam in a photonic lattice. It is implemented by an explicit finite difference method. An explicit method is adopted, due to the multidimensionality of the problem and the presence of nonlinearity.