On Elastic Geodesic Grids and Their Planar to Spatial Deployment

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We propose a novel type of planar-to-spatial deployable structures that we call elastic geodesic grids. Our approach aims at the approximation of freeform surfaces with spatial grids of bent lamellas which can be deployed from a planar configuration using a simple kinematic mechanism.

Such elastic structures are easy-to-fabricate and easy-to-deploy and approximate shapes which combine physics and aesthetics. We propose a solution based on networks of geodesic curves on target surfaces and we introduce a set of conditions and assumptions which can be closely met in practice. Our formulation allows for a purely geometric approach which avoids the necessity of numerical shape optimization by building on top of theoretical insights from differential geometry.

We propose a solution for the design, computation, and physical simulation of elastic geodesic grids, and present several fabricated small-scale examples with varying complexity. Our method is intended as a form-finding tool for elastic gridshells in architecture and other creative disciplines and should give the designer an easy-to-handle way for the exploration of such structures.