TECHNOLOGY OFFER

Elastic Geodesic Grids for the Approximation of Free-form Surfaces

At TU Wien a novel method was developed to calculate a flat grid of straight bars from a proposed free-form surface. With only one single movement, the grid can be deployed to match the desired three-dimensional shape. The result is a robust, load-bearing structure. The grids for such structures can be easily and inexpensively manufactured, transported, and erected. Therefore, they are not only perfectly suited for the construction of basic domes, but also for more complicated structures such as lightweight facades, roofs, or freestanding canopies.

BACKGROUND

From a geometrical point of view, the grid on the free form surface consists of geodesic lines, a special type of a surface curve. The flat grid consists of straight lines that are equal in length to the geodesic lines. In the practical construction of the designs, the grid bars are implemented as thin lamellas, which are connected by screws at their intersections.

Until now, the simulation and construction of elastic gridshells in their final form was a time-consuming process that involved several form-finding iterative steps, and a lot of manual work.

Images: The planar grid (left) deploys to a 3D structure (right)   *Click here to watch the video*

TECHNOLOGY

With the novel method the planar grid and the grid on the free-form surface can be determined simultaneously. The novel algorithm creates the layout of the grid so that it matches the shape of the surface. The planar grid is initially flat and deforms three-dimensionally when it is deployed.

Finding the grids only takes tenths of a second to seconds and requires no complex numerical procedures. The planar grid can be continously deformed to the spatial state and back.

Further reading: Publication in ACM, 125, 07/20 doi.org/10.1145/3386569.3392490

ADVANTAGES

- Our form-finding strategy avoids multiple iterations and computes grids in seconds
- Easy to use method, even for non-expert users
- Delivers fast and stable results without layout-editing iterations
- Realization of free-form shapes from flat, off-the-shelf, or easy-to-produce materials
- Grids approximate the free-form surface with high accuracy
- Broad scope of applications
- Material-saving, cost efficient technique

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www.wtz-ost.at

REFERENCE:
M028/2020

APPLICATIONS:

Free-form architecture, precast formwork, lightweight bending-active structures, facades, domes, etc.

KEYWORDS:

- Elastic gridshell
- Geodesic pattern
- Architectural geometry
- Free-form
- Active bending
- Lightweight structures

IPR:

Patents pending

OPTIONS

- R&D collaboration
- License agreement
- Sale

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