Designing for hot-blade cutting: Geometric Approaches for High-Speed Manufacturing of Doubly-Curved Architectural Surfaces

In this paper we present a novel method for the generation of doubly-curved, architectural design surfaces using swept Euler elastica and cubic splines. The method enables a direct design to production workflow with robotic hot-blade cutting, a novel robotic fabrication method under development by authors of the paper, which facilitates high-speed production of doubly-curved foam moulds. Complementary to design rationalisation, in which arbitrary surfaces are translated to hot-blade-cuttable geometries, the presented method enables architects and designers to design directly with the non-trivial constraints of blade-cutting in a bottom-up fashion, enabling an exploration of the unique architectural potential of this fabrication approach. The method is implemented as prototype design tools in Matlab, C++, GhPython, and Python and demonstrated through cutting of expanded polystyrene foam design examples.
Surface Design and Rationalization for Robotic Hotwire and Hotblade Cutting Techniques

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Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Digital Factory
Collaboration with Odico APS and GXN. Constraint based design and rationalization for robotic hot-wire and hot-blade production of architectural formwork. Supported by Innovation Fund Denmark

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