Robotic Hot-Blade Cutting: An Industrial Approach to Cost-Effective Production of Double Curved Concrete Structures

This paper presents a novel method for cost-effective, robotic production of double curved formwork in Expanded Polystyrene (EPS) for in situ and prefabricated concrete construction. A rationalization and segmentation procedure is developed, which allows for the transilibration of double curved NURBS surfaces to Euler elastica surface segments, while respecting various constraints of production. An 18 axis, tri-robot system approximates double curved NURBS surfaces by means of an elastically deformed and heated blade, mounted on the flanges of two manipulators. Re-orienting or translating either end of the blade dynamically deforms the blade’s curvature. The blade follows the contours of the rationalized surface by continuous change in position and orientation of the end-effectors. The concept’s potential is studied by a pilot production of a full-scale demonstrator panel assembly.