ROBOTIC FUTURES

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建筑机器人建造

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Mesh Mould

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在“网格模型”项目中，加密及模压这两个独立要求在现场机器制造过程中得以合而为一。现场直接挤压模压在简化流程的同时，可应对更复杂的几何结构。由于材料用量被降至最低，此种方式最大创造了能效。在当前情况下，机器人挤压工艺可处理各种热塑性塑料材料，从熔融层积累挤出的挤压材料在表面形成打印机打印出来密度较高的材料，多用于复杂的表层和形状控制的模型。在此基础上，可针对不同类型的结构，同时减少生产时间及产品重量。

In Mesh Mould, two separate requirements – reinforcement and formwork – are folded into one single in situ robotic fabrication process. The direct extrusion of the in situ formwork allows for a greater geometric complexity while simplifying the process itself. Since the amount of the required material is reduced to a minimum, such an approach holds a high potential for resource efficiency. At our current conditions, the robotic extrusion technique can process different kinds of thermoplastic materials. The conceptual change from layer-based deposition to spatial extrusion has noteworthy implications. Whereas the former remains generic, mostly for the representation of form, the digitally controlled spatial extrusion becomes specific to the architectural construction and allows for a significant and simultaneous reduction of both weight and production time. The project (US Provisional Patent Application No. 61,873,467) is conducted in close collaboration with Sika Technology AG as an industry partner and expert in cement-based materials.
Mesh Mould

Collaborators: Norman Hack (project lead), Willi Viktor Lauer
Industry Partner: Sika Technology AG

Over 60 per cent of the costs of a concrete structure are due to the labour-intensive construction of formwork, and bending and placing of reinforcement accounts for another significant share. Mesh Mould proposes the unification of these two systems into one combined formwork-reinforcement system. The 3D mesh structures are robotically fabricated in an additive, waste-free manner, providing increased geometric complexity without raising the costs. © All images by Gramazio Kohler Research, ETH Zurich.

A few large acrylonitrile butadiene styrene (ABS) samples with sizes of approximately 80cm×60cm×8cm were fabricated to test the robustness of the process. © All images by Gramazio Kohler Research, ETH Zurich.