

UNIVERSITÉ DE NANTES

Title: Industrialization of a 3D printing technology for the construction of sustainable housing.

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Abstract
The objective of this paper is to present how robotics permits improvement of construction and building. The comparison will be made with the manufacturing industry for which the robots have operated for many years. To illustrate a robotic system developed to apply a new advanced Additive Manufacturing (AM) process will be presented: Batiprint3dTM. The proposed advanced technology consists of creating a complex wall of 3D-printed materials using a mobile and polyarticulated robot: two polymer-foam printed walls are used to encase a subsequent third wall made of concrete. By using 3D printing for the foam and extrusion of the concrete with the same robotic system, the technique creates jointly both the structure and thermal elements of the building. In the first part of this paper the composite foam/concrete 3D printing method are presented and the idea of a robotics system adapted for building on-site will be developped. In the second part, an experiment in full scale using this new walls 3D printing method will be presented, it is the construction of Yhnova, a real 95m² social housing. In the third part, other robotics solutions dedicated to construction will be presented.

This technology Batiprint3d have been used to build a certified, validated and inhabited house; it is possible now to propose a synthesis of the impacts of this new advanced technology for construction.

Figures if any (BW/Color):





Recent Publications (minimum 5)

T. LESPRIER- P. MOGNOL- **B. FURET** - J-Y. HASCOET, " A new method of prototypes and dies manufacturing " Journal of Engineering Manufacture October 2004 Vol 218 N° B10
C.DUMAS, A. BOUDELIER, S. CARO, **B. FURET**, S. GARNIER, M. RITOU, “Development of a robotic cell for trimming of composite parts”, Mechanics & Industry 12, 487–494 (2011),
A. KLIMCHIK, A. AMBIEHL, S. GARNIER, **B. FURET**, A. PASHKEVICH, Comparison Study of Industrial Robots for High-Speed Machining, Mechatronics and Robotics Engineering for Advanced and Intelligent Manufacturing, Lecture Notes in Mechanical Engineering, Springer, 2017
K. SUBRIN, T. BRESSAC, S GARNIER, A. AMBIEHL, E PAQUET, **B. FURET**, Improvement of the mobile robot location dedicated for habitable house construction by 3D printing, IFAC-PapersOnLine Volume 51, Issue 11, 2018
Ph. POULLAIN, E PAQUET, S GARNIER, **B. FURET**, On site deployment of 3D printing for the building construction, January 2018, MATEC Web of Conferences 163(5):01001
B. FURET, P. POULLAIN, S. GARNIER, 3D printing for construction based on a complex wall of polymer-foam and concrete, Additive Manufacturing (2019),

Biography

Benoit FURET: After an engineer high school in Nantes and MSc degree at E.N.S. Cachan, in 1994, his PhD was on monitoring in machining. Currently, he is full Professor at the University of Nantes and researcher in LS2N Lab. He developed the following research topics: Robotics for machining, Process Monitoring, Smart Machining, Additive Manufacturing, 3D printing for construction... He has supervised 15 PhD and 36 MSc Students. He is author or co-author of 52 articles in international journals, 112 oral Communications at Conferences and of 8 patents. He has work on more than 27 research projects. He is involved in H2020 european COROMA, CleanSky RODEO projects and the BATIPRINT3D project.

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