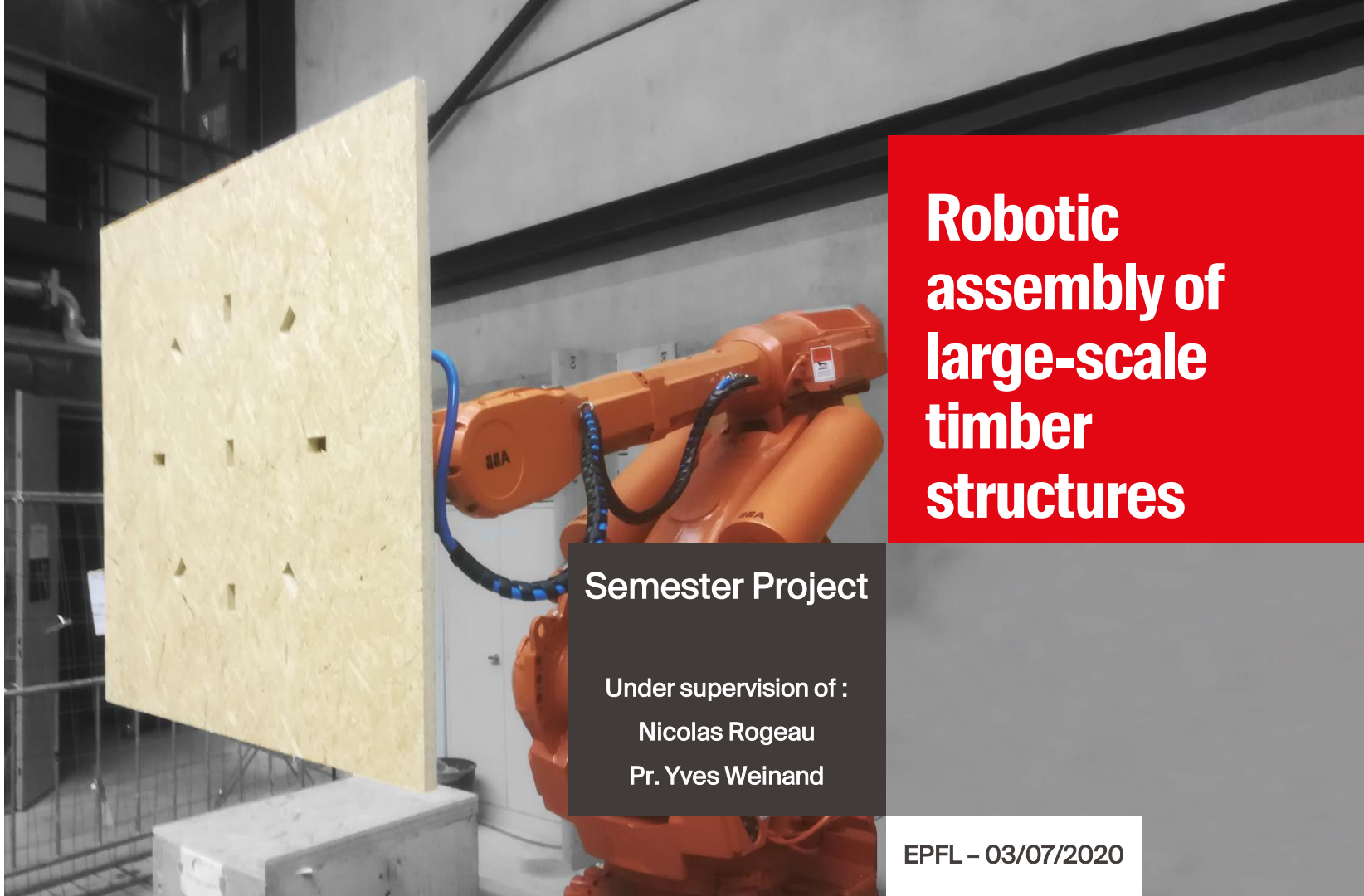
EPFL IBOIS

National Centre of Competence in Research Digital Fabrication



Robotic assembly of large-scale timber structures

Semester Project

Under supervision of :

Nicolas Rogeau

Pr. Yves Weinand

EPFL – 03/07/2020

École polytechnique fédérale de Lausanne

IBOIS Research

Tōdai-ji Temple, Nara, 752

Robotic Integral Attachment, 2017

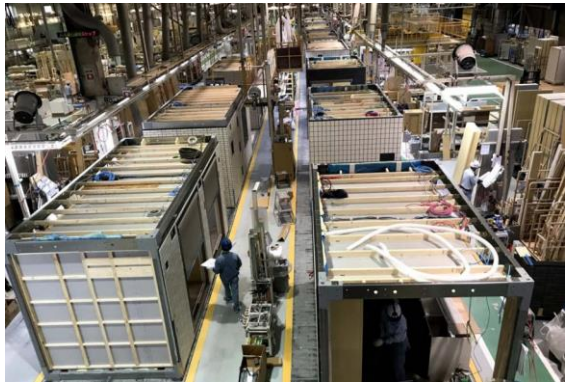
Linear elements	→	**Planar elements**
Wood-wood connections		Wood-wood connections
Manual fabrication	→	**Digital fabrication**
Manual assembly	→	**Robotic assembly**

Technology transfer

Vidy theater, Lausanne, 2018

Annen head office, Manternach, 2020

Automation of the timber construction sector



◀ Sekisui, JP

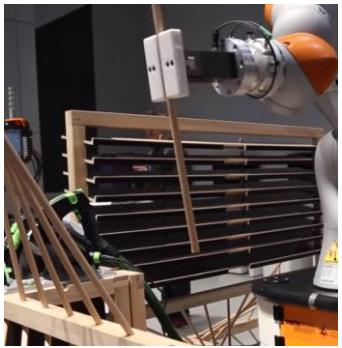
◀ Mobic, BE

◀ Katerra, US

- From mass **prefabrication**...
  ...to mass **customization**
- From **off-site** assembly...
  ...to **on-site** assembly

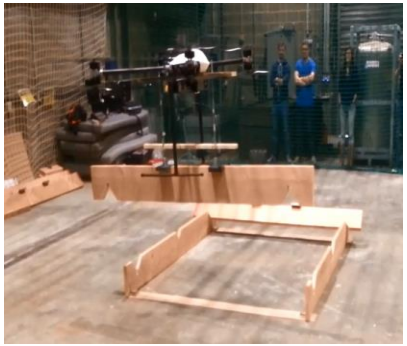
Robotic assembly of timber elements

- Sensitive insertion



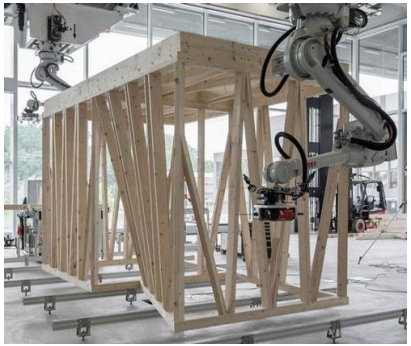
DIANA
S. Brell-Cokcan, S. Jeschke
RWTH, 2016

- High tolerance



Drone-Compatible Timber Structures,
P. Latteur et al.
EPL, UCL, 2017

- Complex path planning

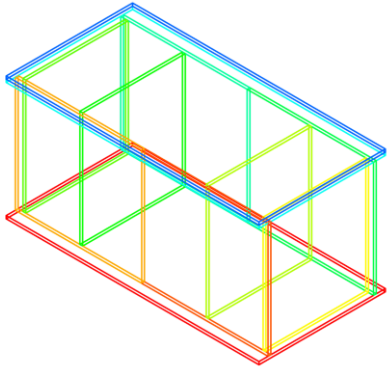


Spatial Timber Assemblies,
Andreas Thoma et al.
GKR, ETHZ, 2018

- Collaborative assembly

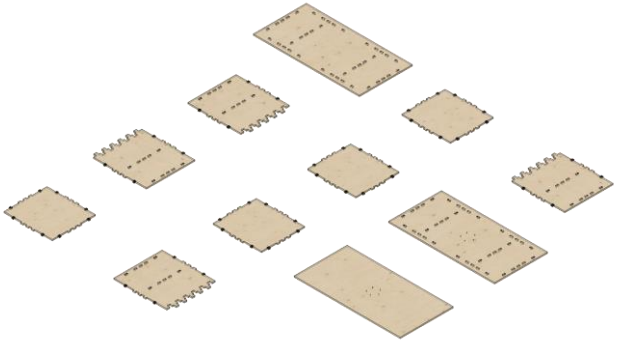
Buga Wood Pavilion
A. Menges, J. Knippers et al.
ICD, ITKE, 2019

Thesis summary



INTEGRATED DESIGN

From global to local scale

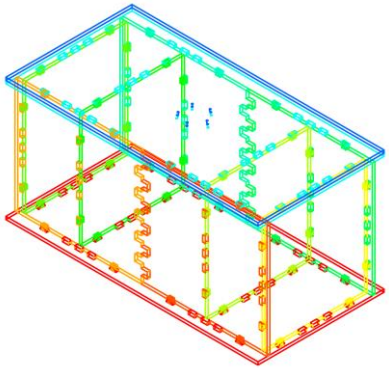


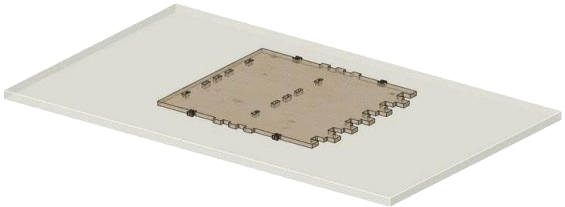
DIGITAL FABRICATION

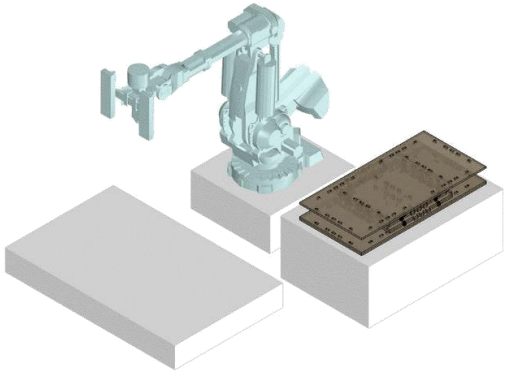
From virtual to physical

ROBOTIC ASSEMBLY

From elements to modules



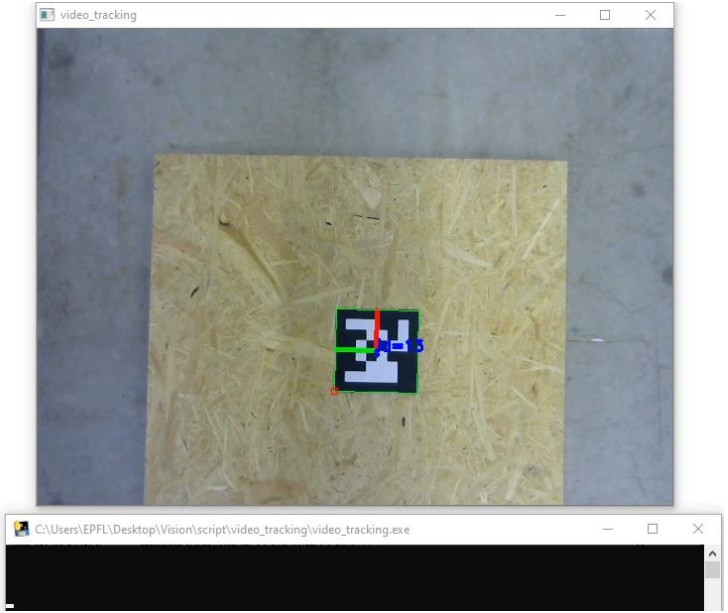





JOULIN
FORCE

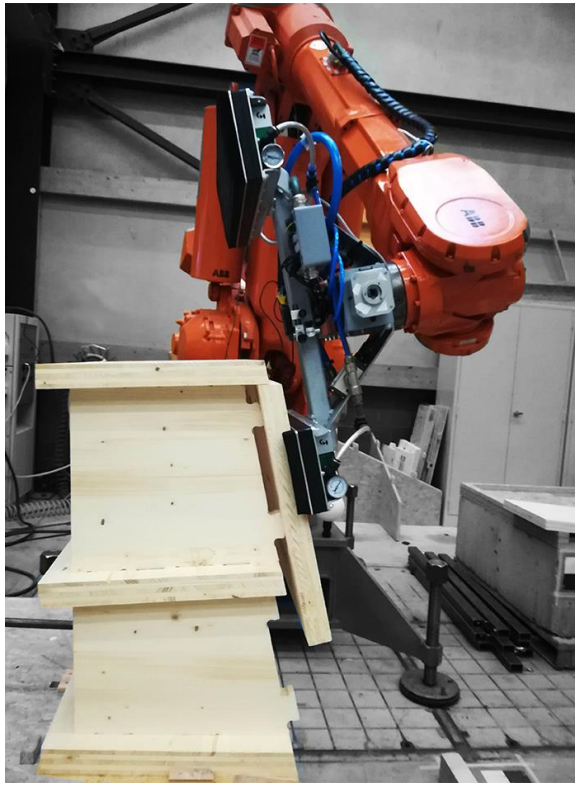
Current situation

- Visual feedback loop
- Low accuracy above 30 cm from target
- Inaccurate orientation of the plate
- Difficult calibration
- Light / contrast problem



Project objectives

- Improve the detection accuracy of the position (1 mm) and orientation (0,1 °) of the robot end-effector in relation to the timber plate.
- Create a feedback loop to update the robot position and orientation with the values obtained and integrate it into the robotics workflow.
- Study potential alternatives or complementary solutions to the visual detection of ArUco markers



Project timeline

Work plan
Presenting the state of the art
Proposing a conceptual solution
Listing required material

Report draft
Writing a clear and concise report

Intermediary presentation
Presenting a first prototype
Listing potential improvements

Introduction to the topic
Getting familiar with the robotic workflow
Understanding the challenges of the research

Final presentation
Submitting final report
Demonstrating the performance of the solution
Providing outlooks and self-evaluation