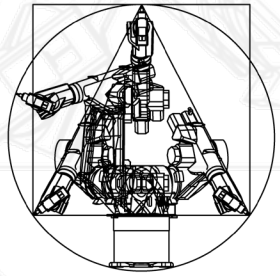
Forum Produktion 2023

Roboterbasierte Fertigung in der Kreativindustrie

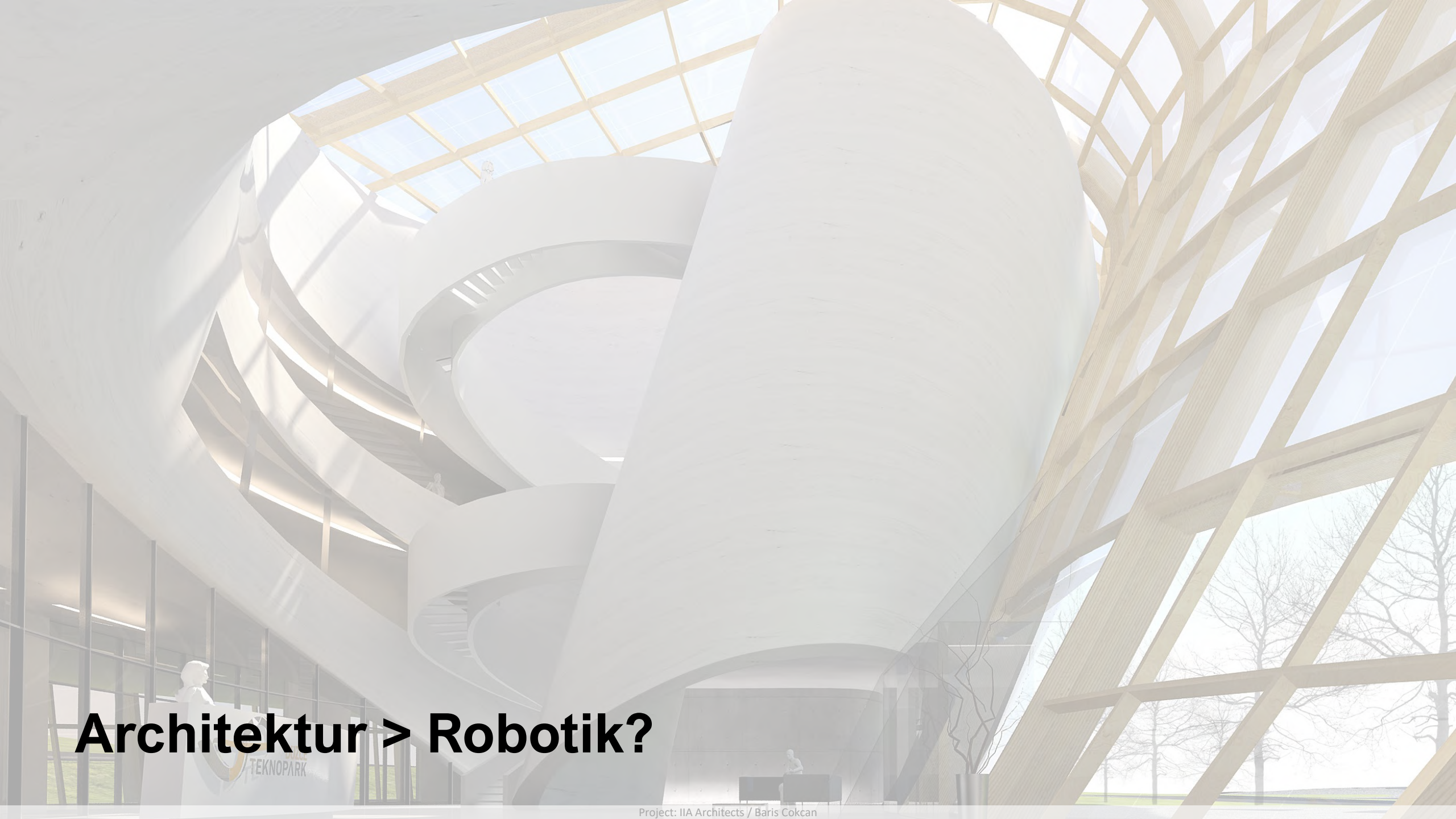
Interdisziplinäre Ansätze zur individualisierten Produktion

Univ.-Prof. Johannes Braumann

CREATIVE ROBOTICS



Association for
Robots in Architecture



Architektur > Robotik?

Project: IIA Architects / Baris Cokcan

Image: Marc Fornes

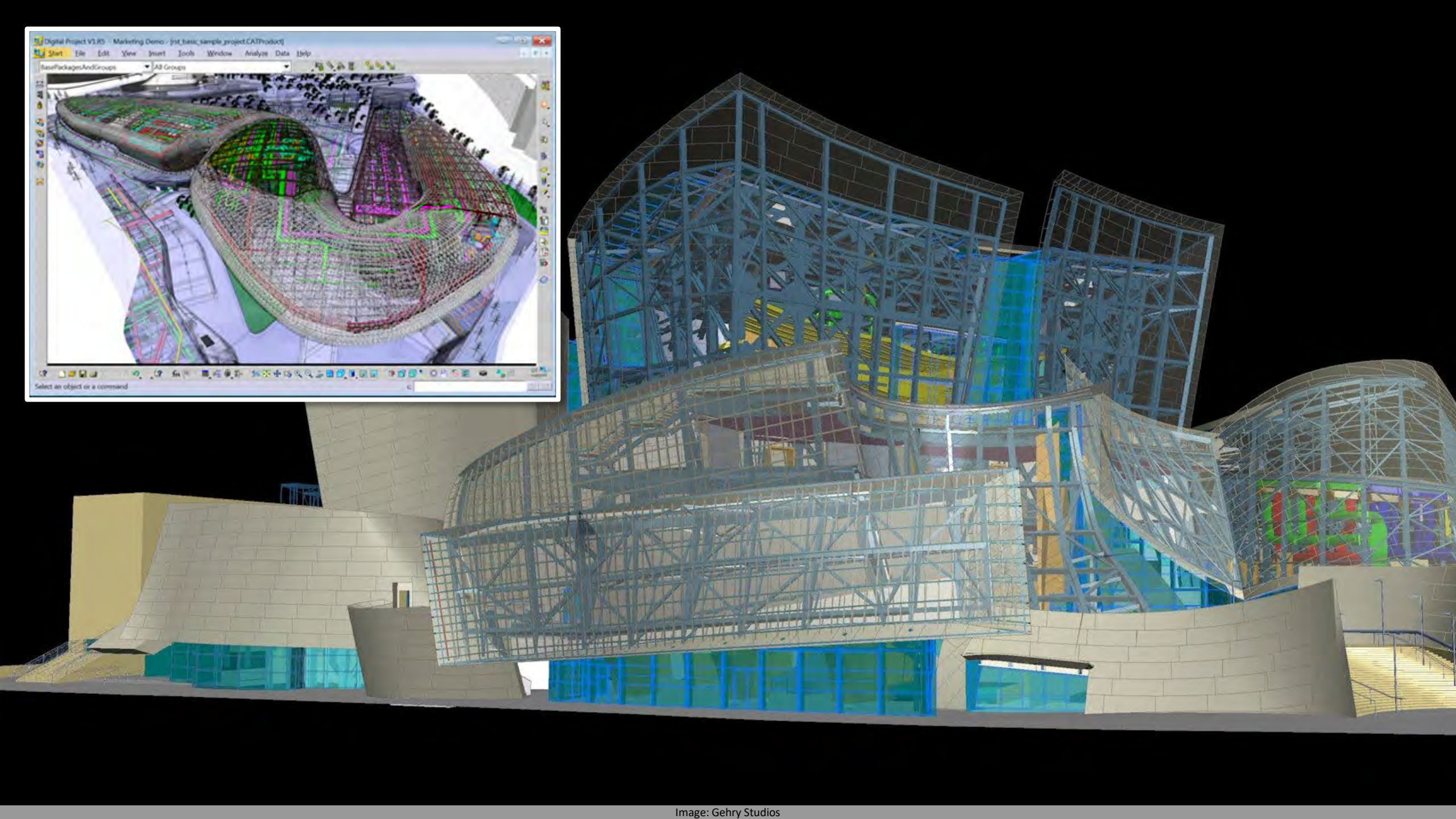
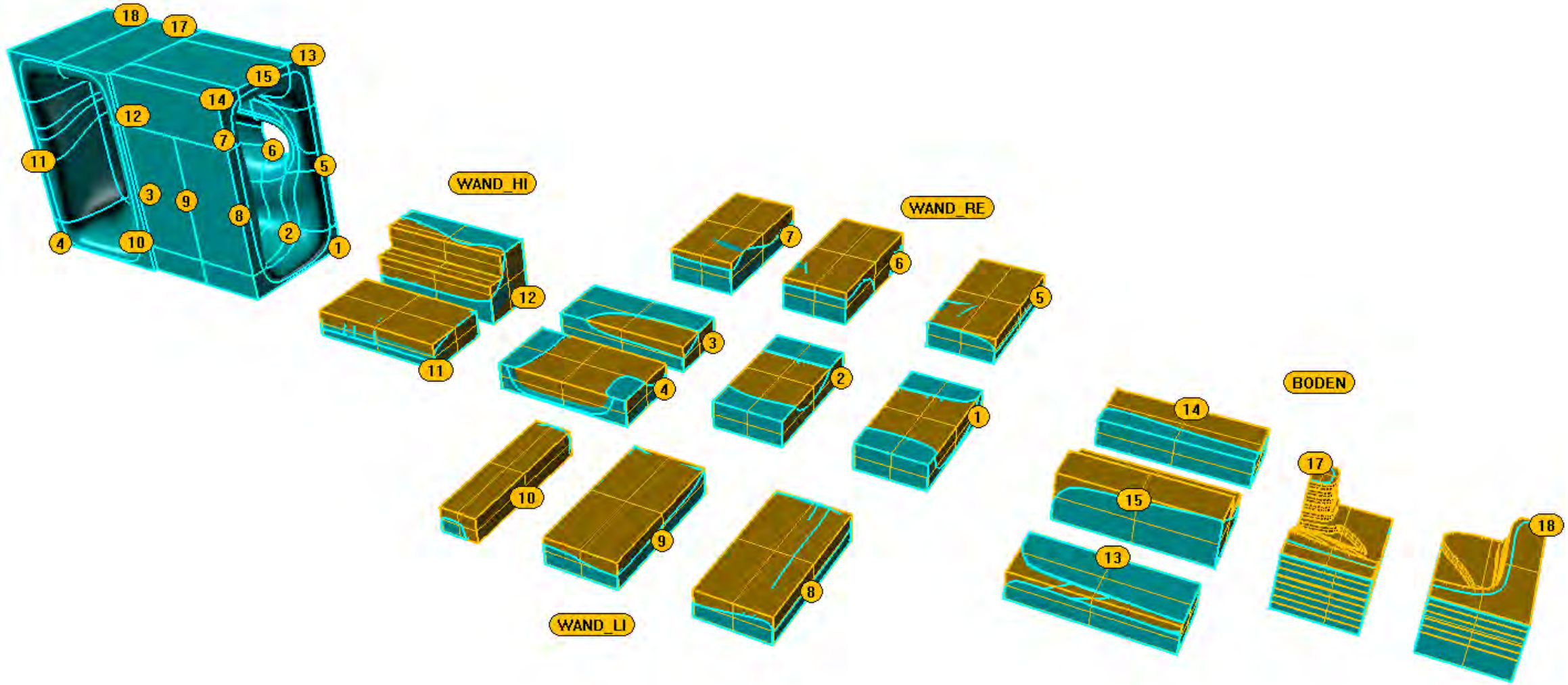


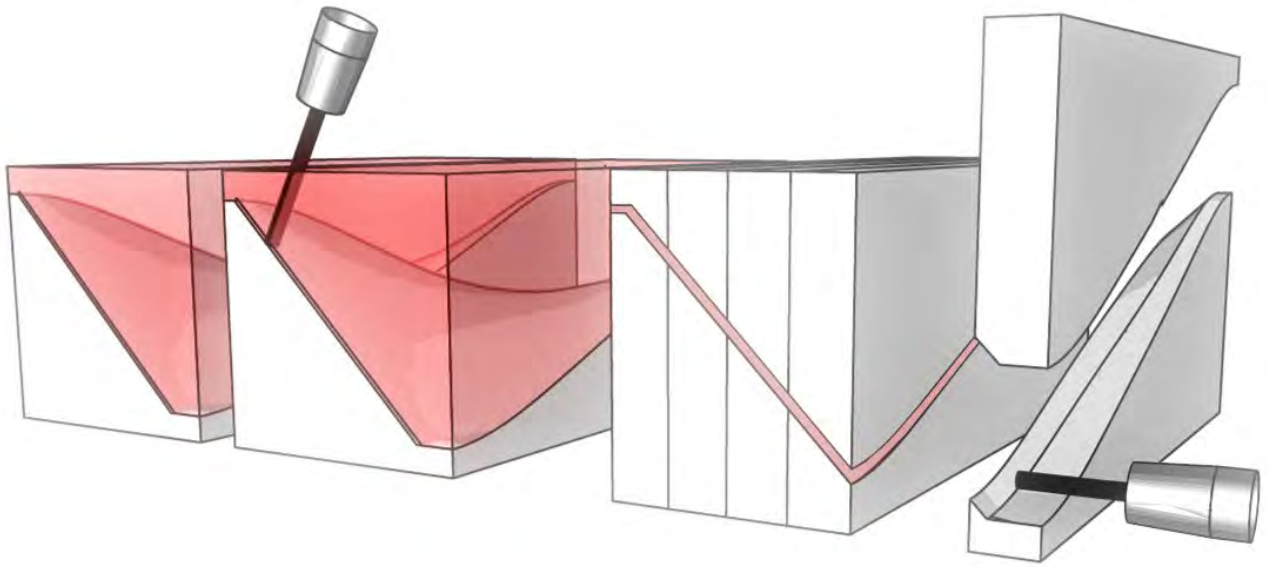
Image: Gehry Studios

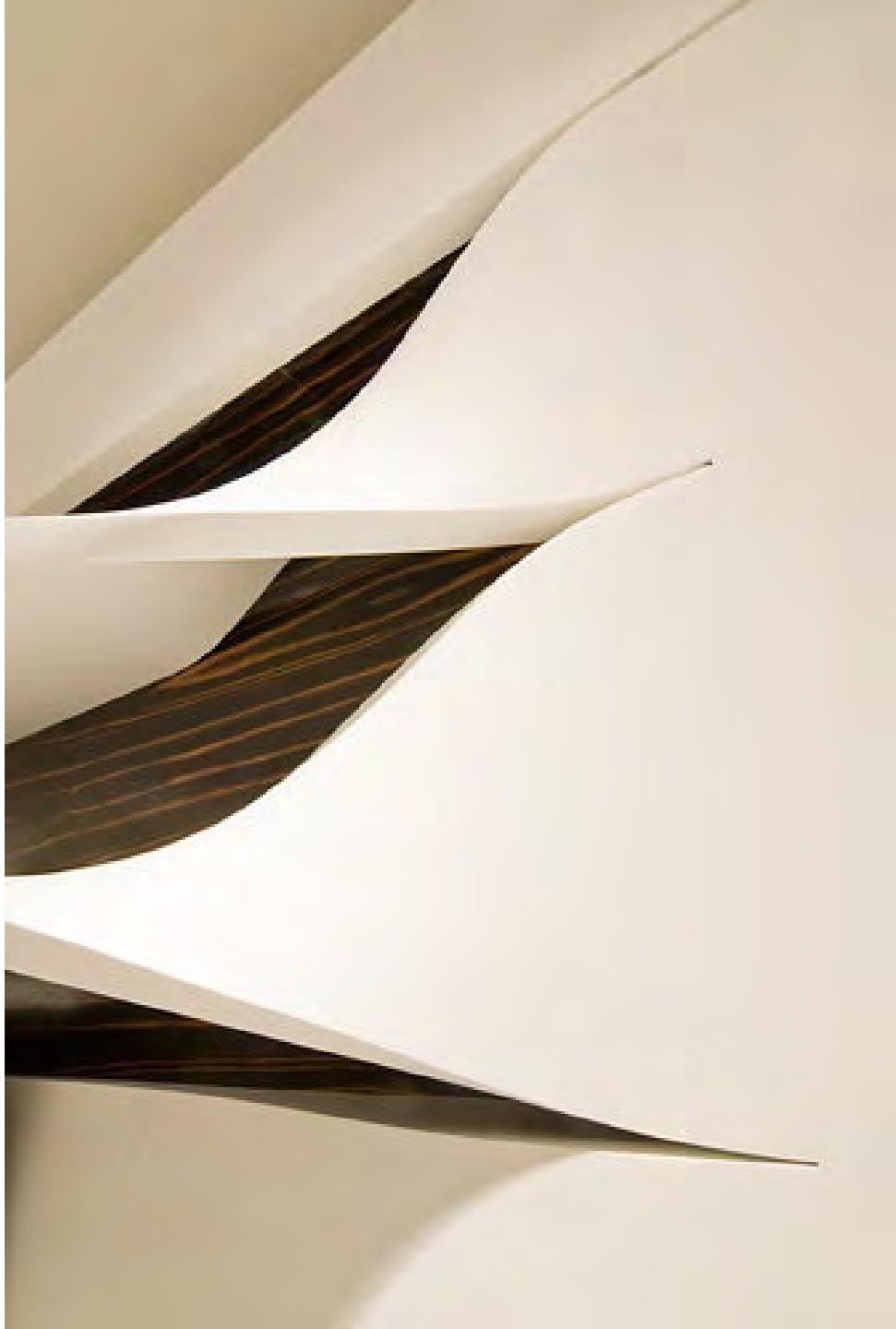
Image: ETH Zürich

Image: Robots in Architecture



Kindergarten: German Embassy | Istanbul, TU Vienna

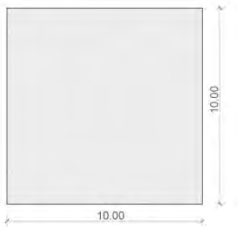




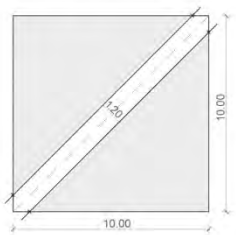
Shop design: Baar Barenfels Architekten, Fabrication Martin Reis

METHODES OF CONSTRUCTION

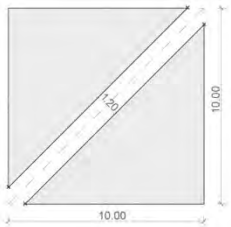
STEP 1
RECTANGLE



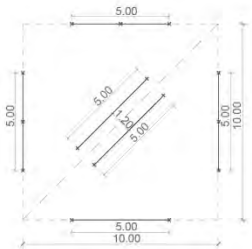
STEP 2
DIAGONAL



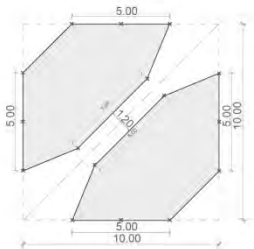
STEP 3
DIVIDE



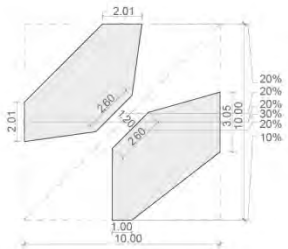
STEP 4
SCALING FACTOR: 0.5

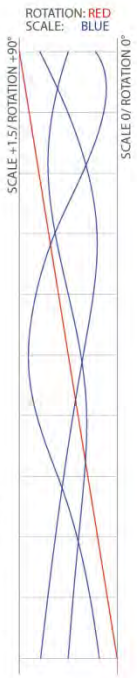


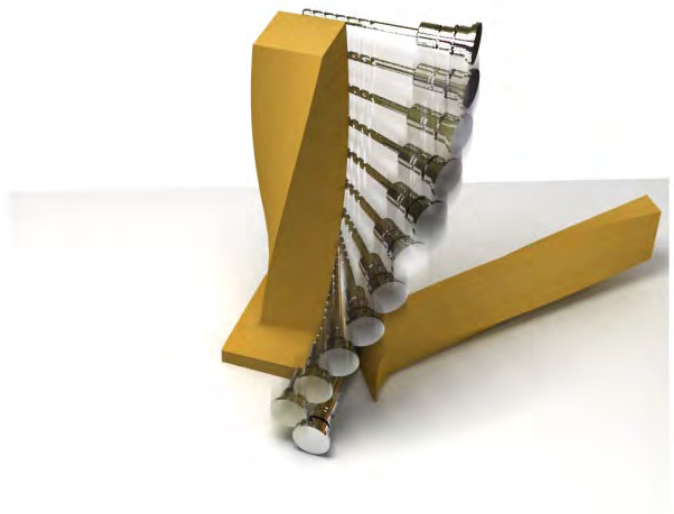
STEP 5
CONNECT



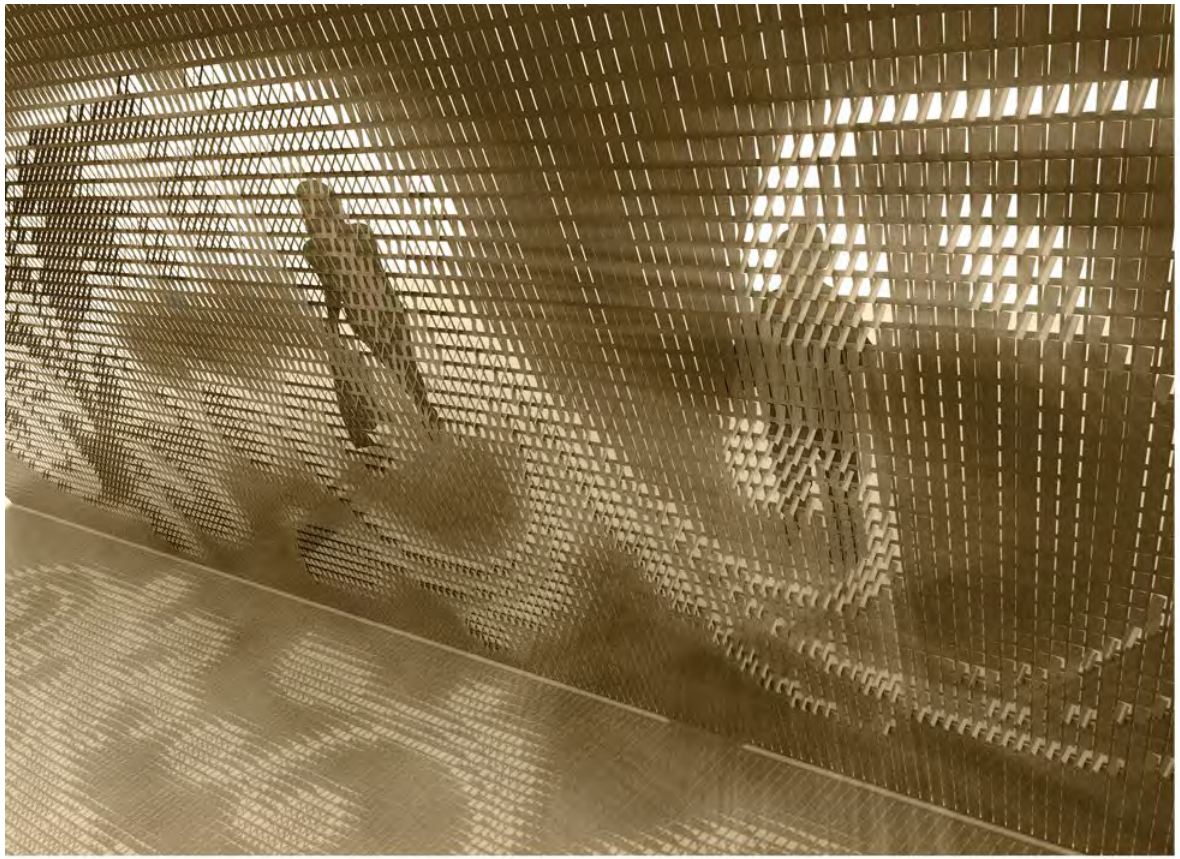
STEP 6
SCALING FACTOR: VARIABLE

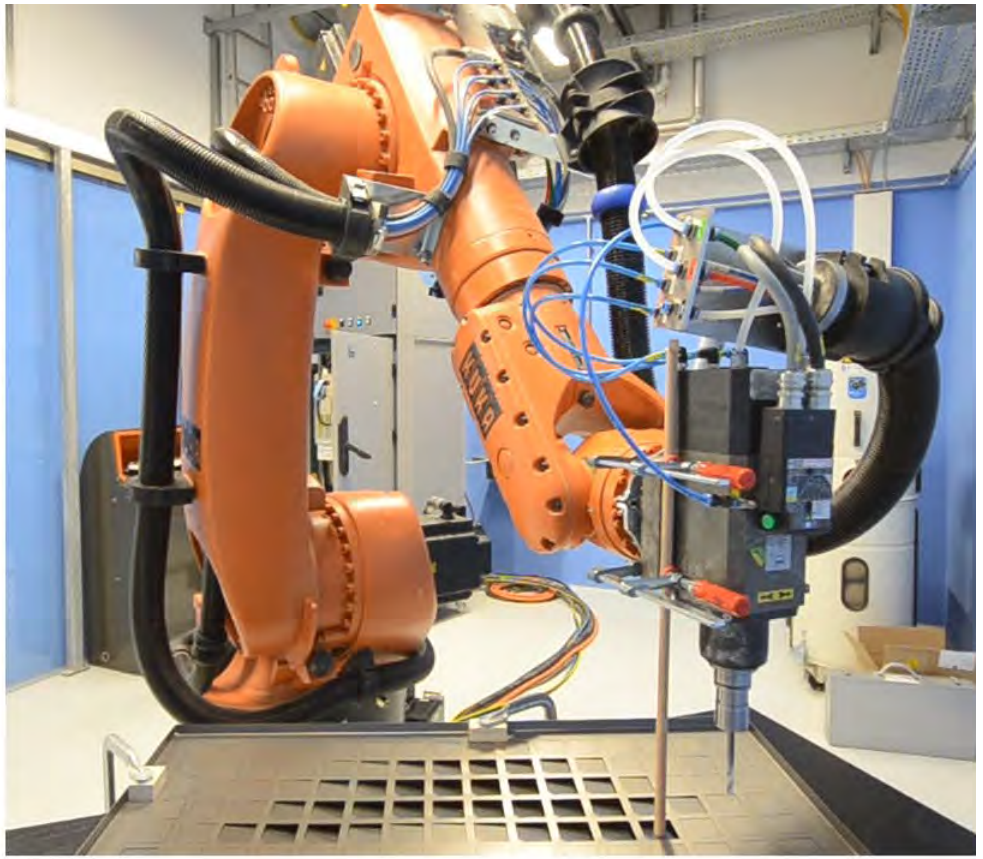






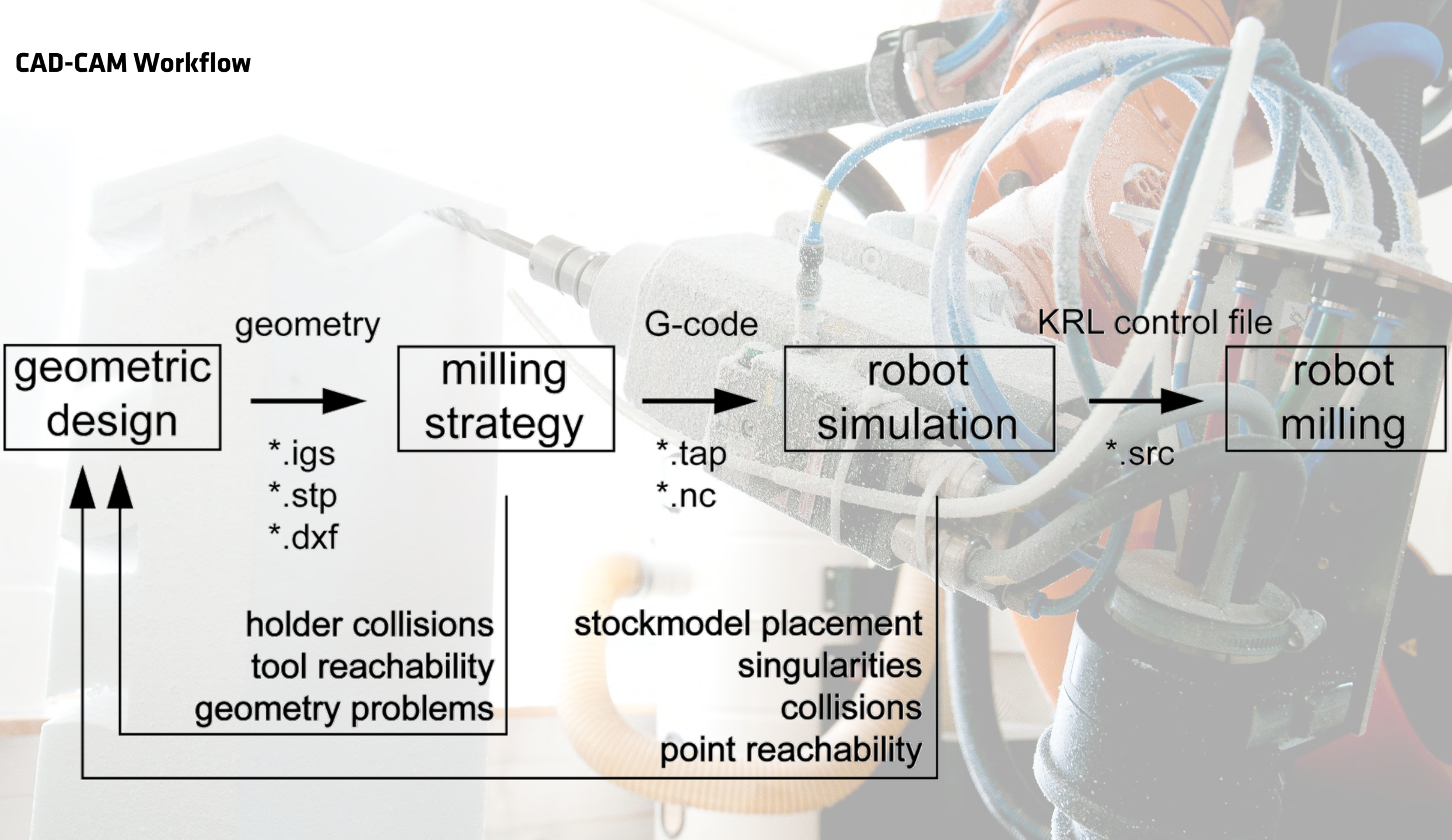
Lukas Aschauer

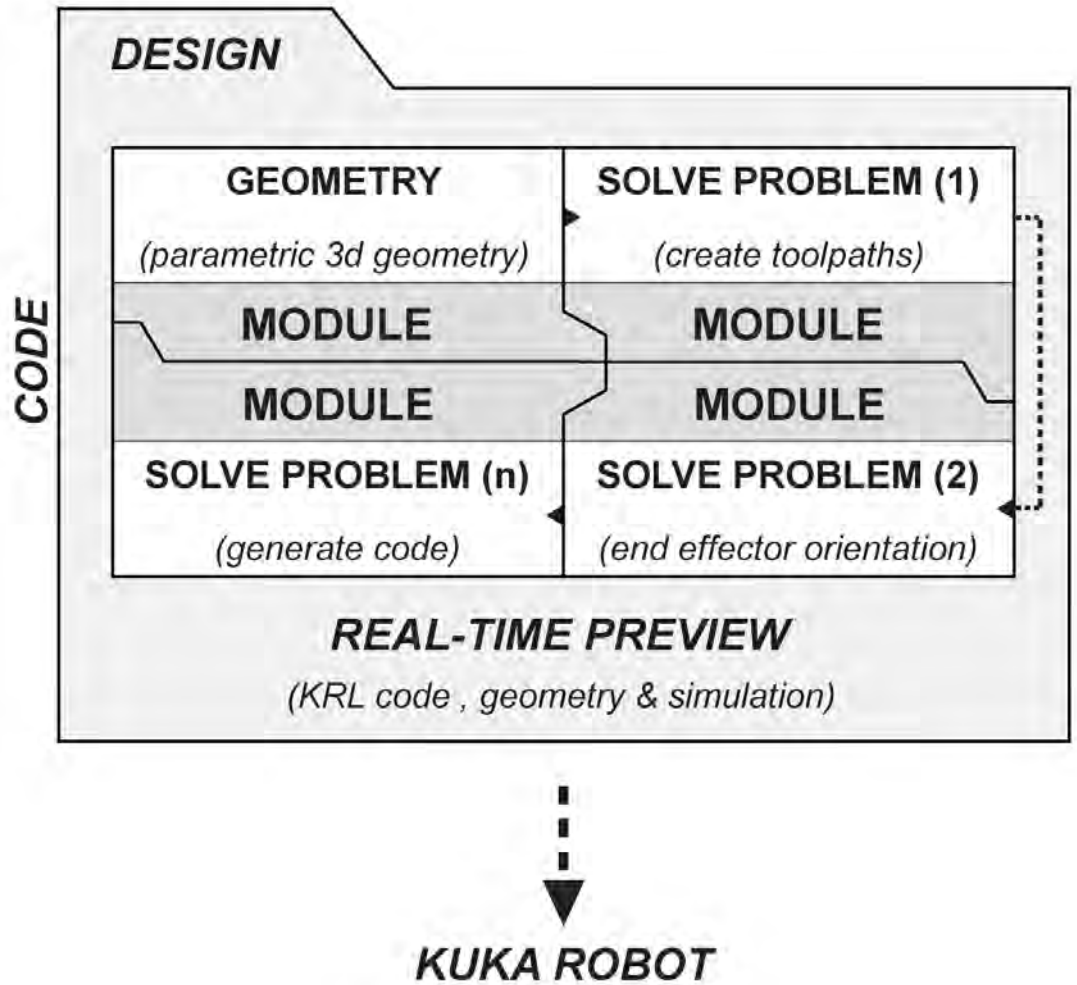




Michael Vasku

CAD-CAM Workflow




DESIGN
GEOMETRY
(parametric 3d geometry)
SOLVE PROBLEM (1)
(create toolpaths)
MODULE
MODULE
MODULE
MODULE
SOLVE PROBLEM (n)
(generate code)
SOLVE PROBLEM (2)
(end effector orientation)
CODE
REAL-TIME PREVIEW
(KRL code , geometry & simulation)
KUKA ROBOT

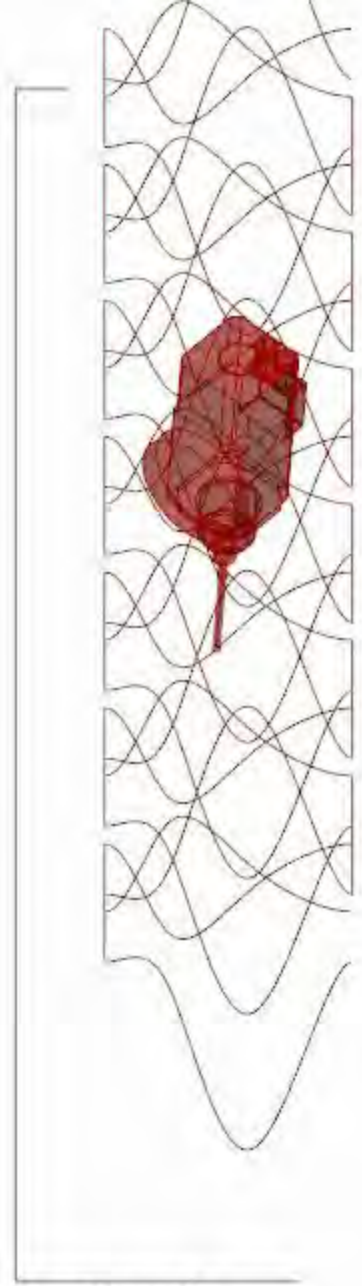
KUKA|prc

parametric robot control

Stacked Preview

Geometry

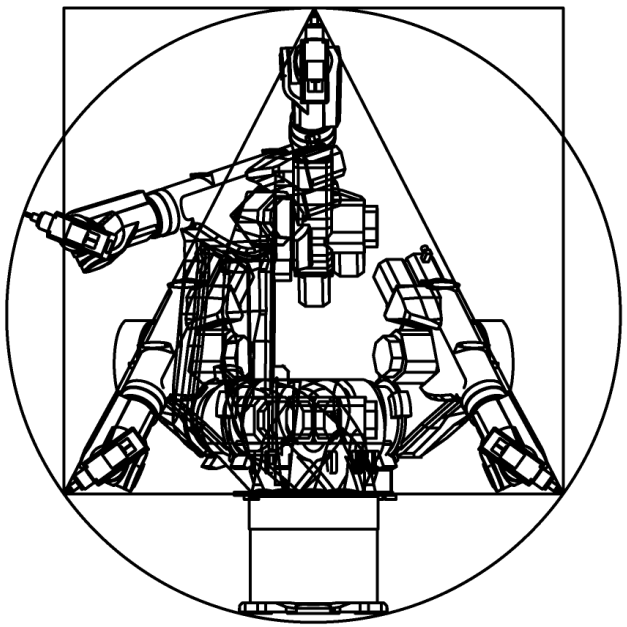
Module Preview



Toolpaths

Image: Robots in Architecture

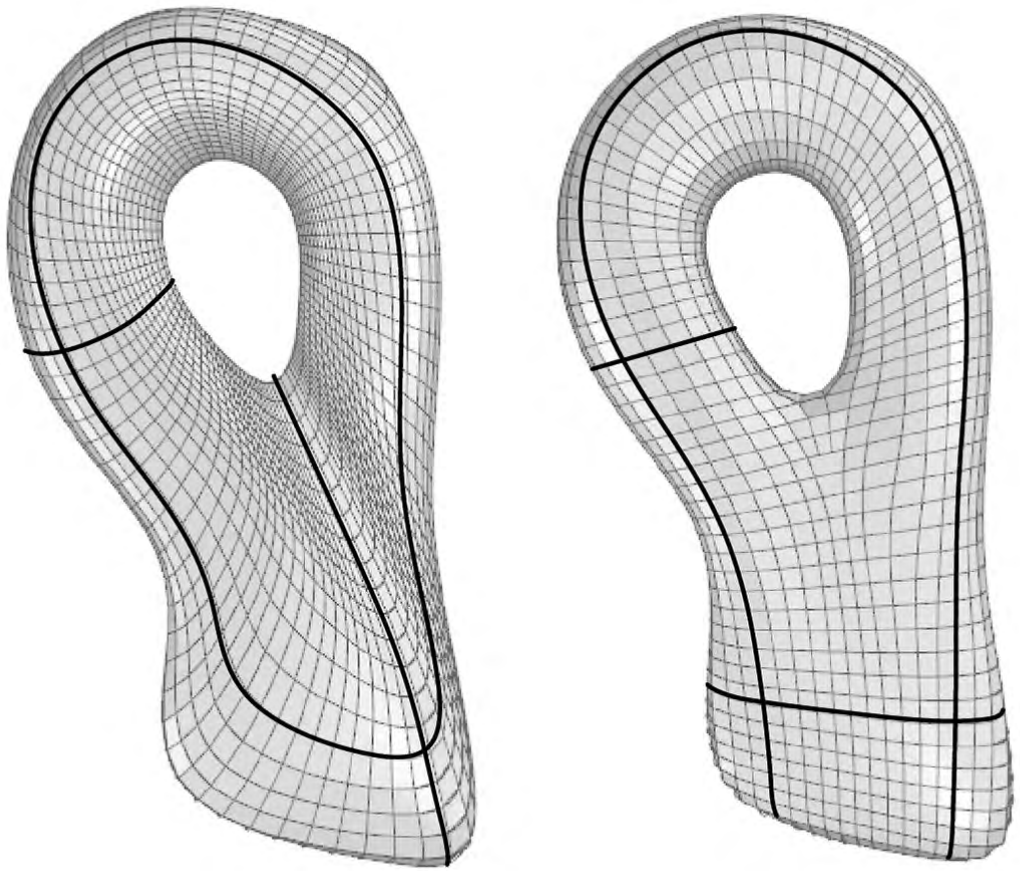
Image: Robots in Architecture

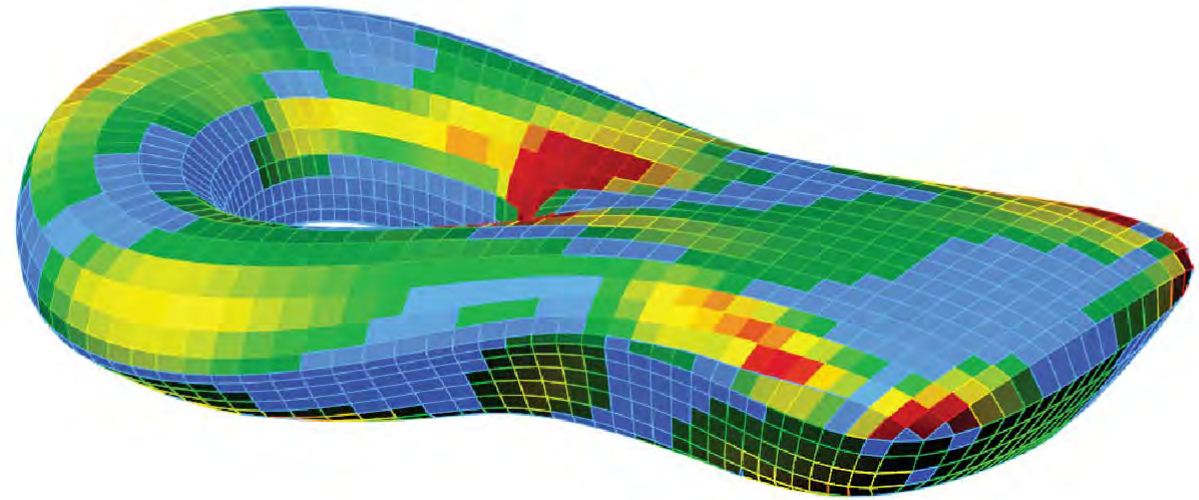


Association for

Robots in Architecture

2009 > Jetzt





Project: IIA Architects / Sigrid & Baris Cokcan

AEC Industry

$10 trillion

1% productivity growth

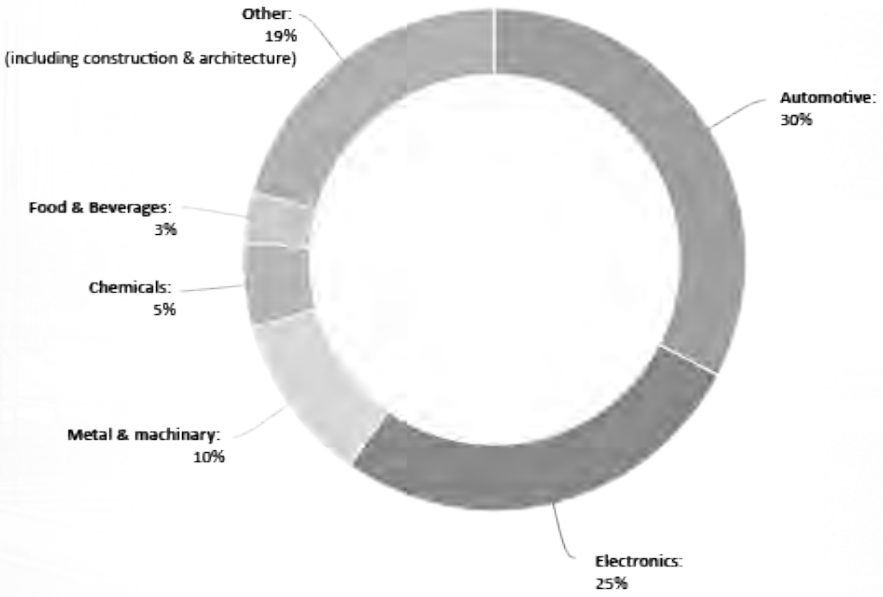
36%
of the total waste generation

Auto. Industry

$2-3 trillion

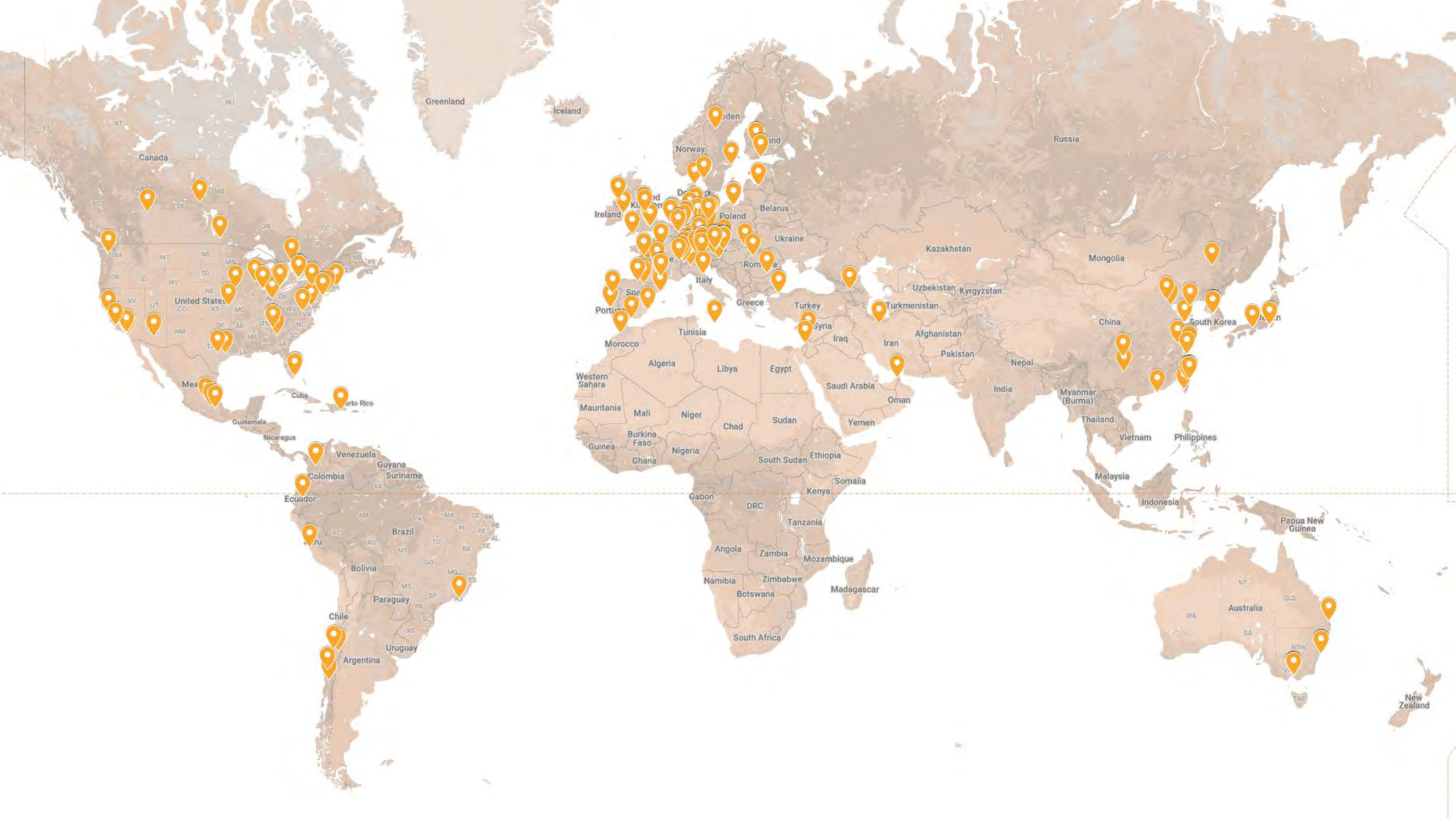
1400% productivity growth

4% waste

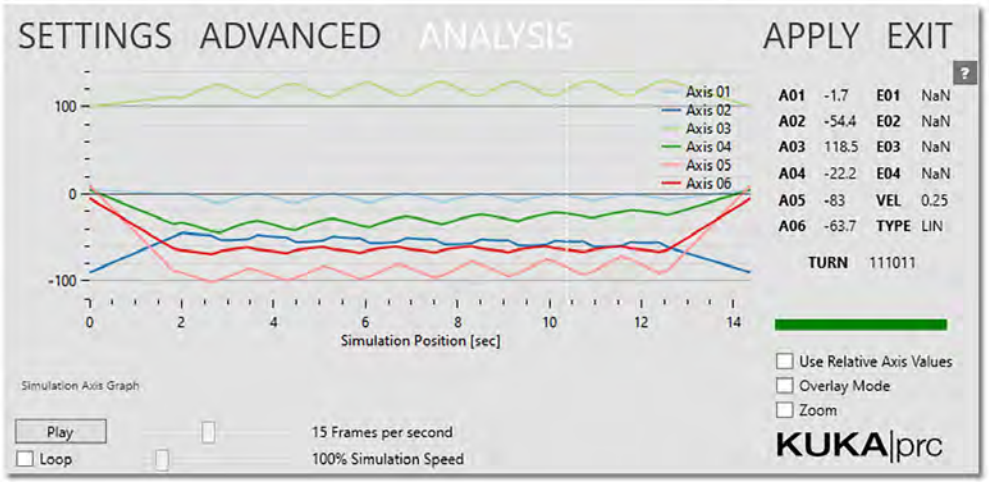


RobIArch 2018

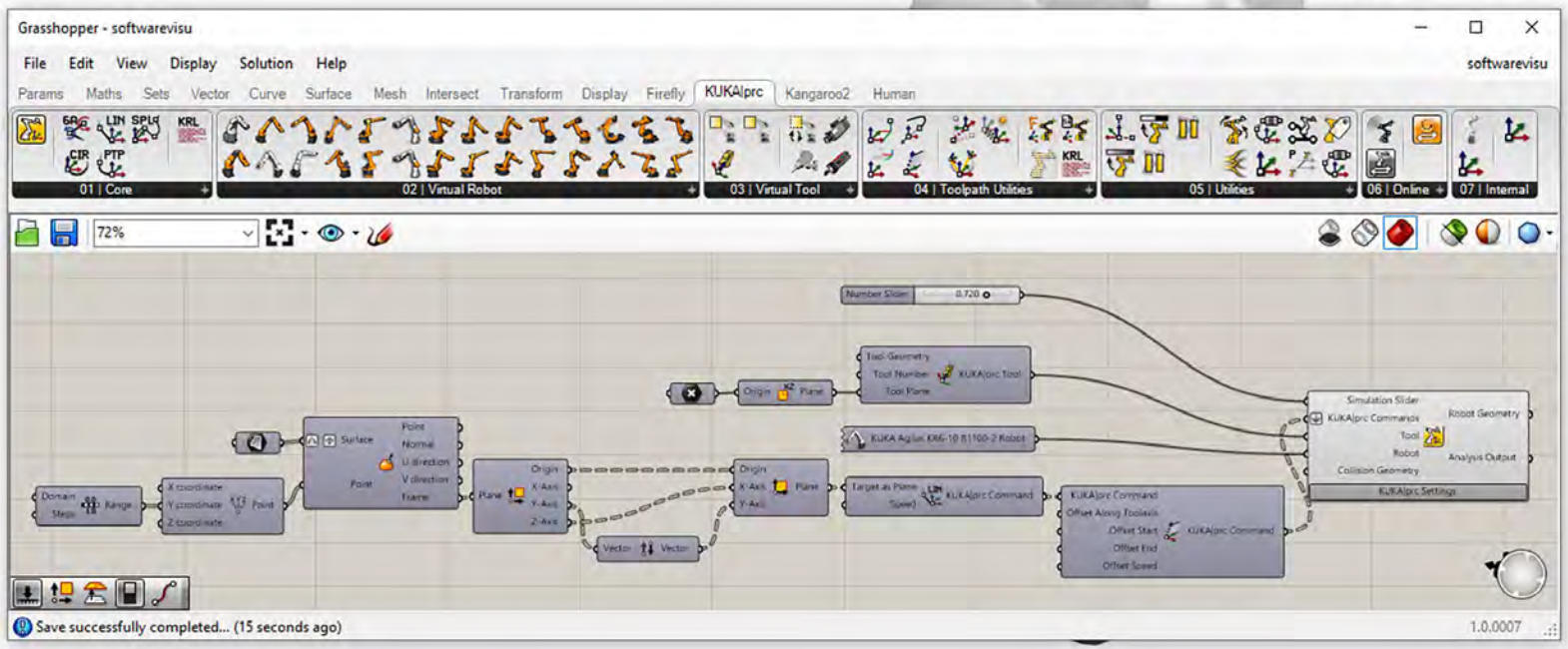
Robotic Fabrication in Architecture, Art, and Design

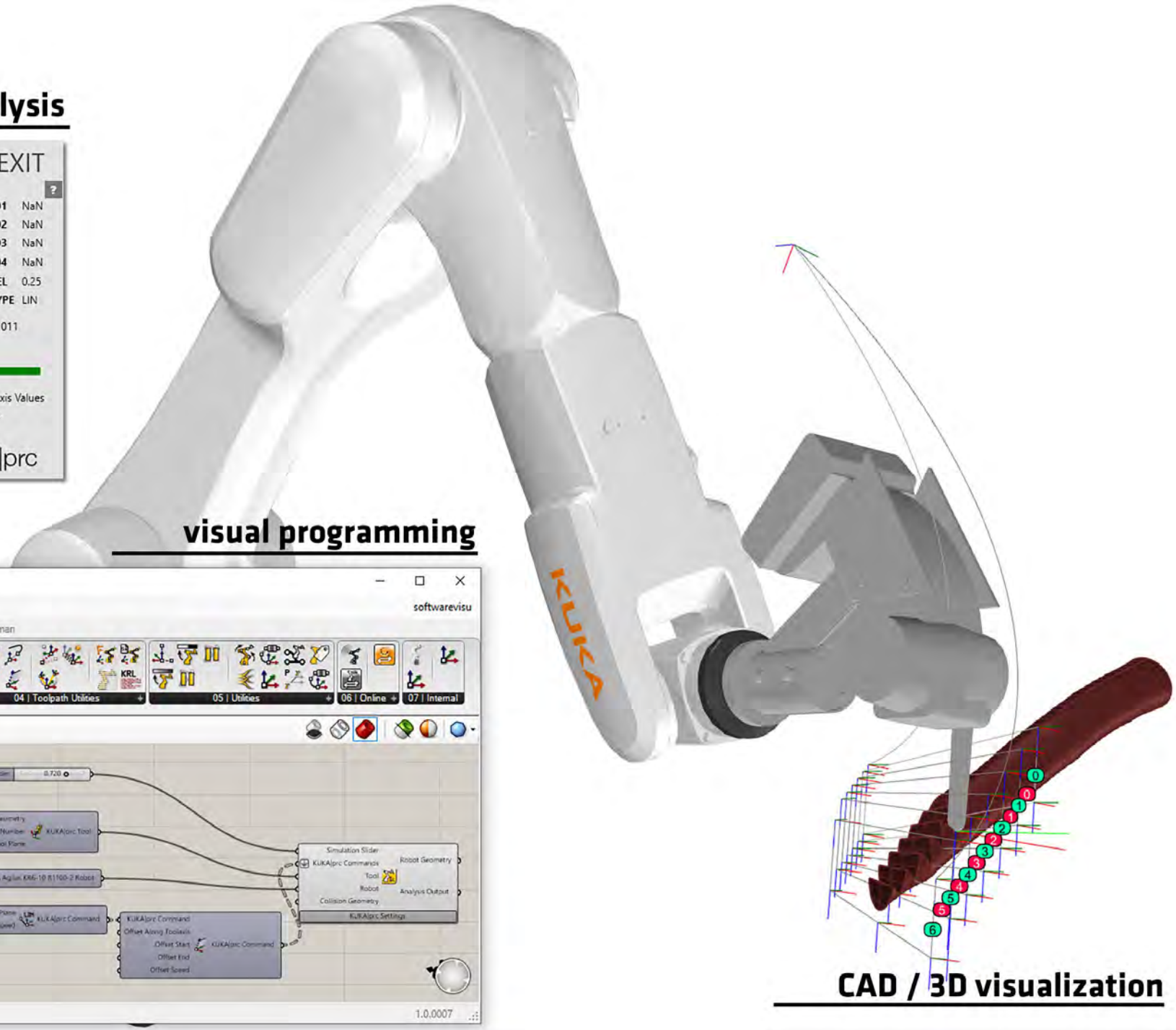

Greenland
Iceland
Canada
United States
Mexico
Cuba
Puerto Rico
Guatemala
Nicaragua
Venezuela
Guyana
Suriname
Colombia
Ecuador
Peru
Brazil
Bolivia
Paraguay
Chile
Uruguay
Argentina
Norway
Sweden
Ireland
Poland
Belarus
Ukraine
Romania
Italy
Spain
Portugal
Greece
Turkey
Russia
Kazakhstan
Mongolia
Uzbekistan
Kyrgyzstan
Turkmenistan
Syria
Iraq
Iran
Afghanistan
Pakistan
China
South Korea
Japan
Nepal
India
Myanmar (Burma)
Thailand
Vietnam
Philippines
Malaysia
Indonesia
Papua New Guinea
Australia
New Zealand
Saudi Arabia
Oman
Yemen
Tunisia
Morocco
Algeria
Libya
Egypt
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Burkina Faso
Guinea
Nigeria
Ghana
South Sudan
Ethiopia
Somalia
Kenya
Gabon
DRC
Tanzania
Angola
Zambia
Mozambique
Namibia
Zimbabwe
Botswana
Madagascar
South Africa

analysis

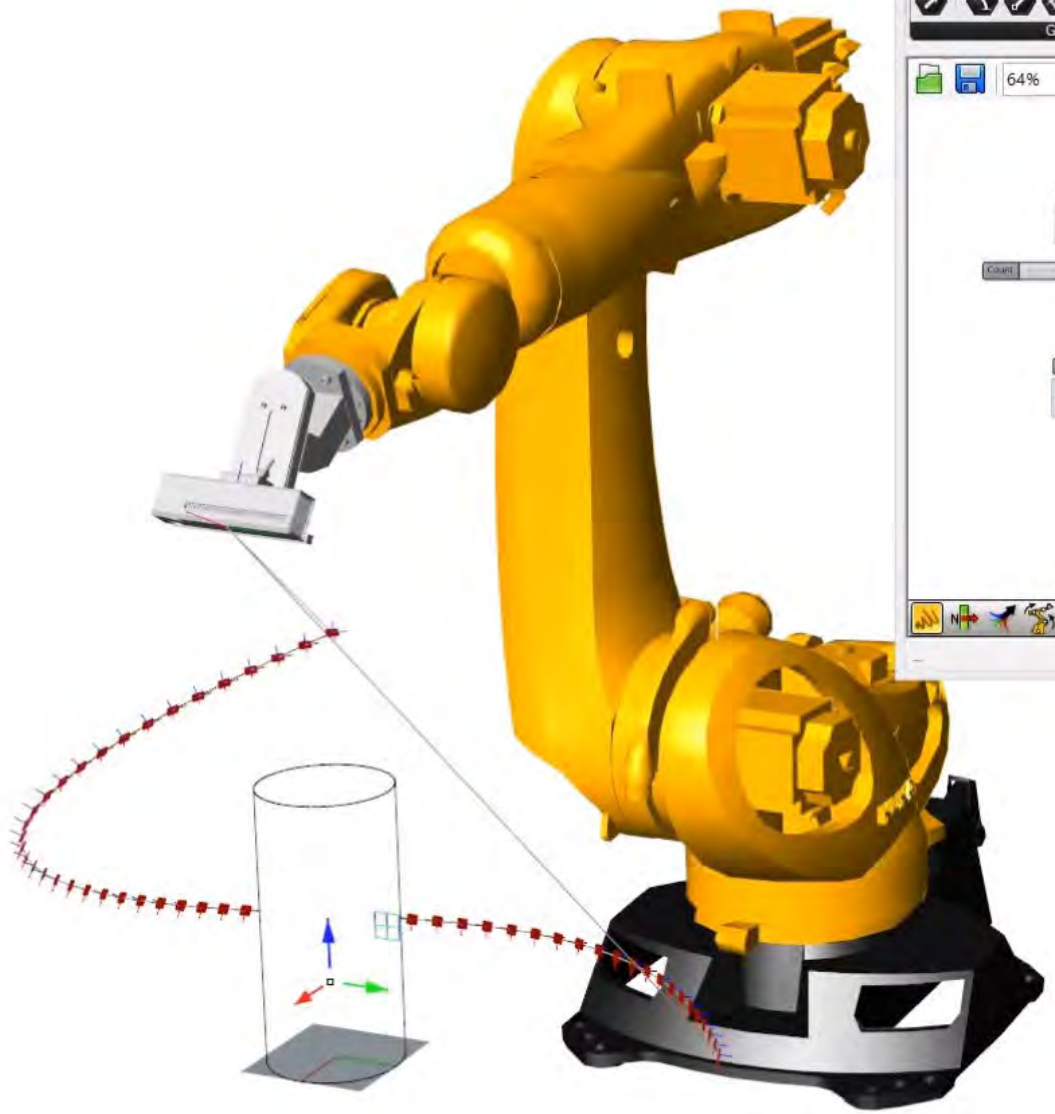


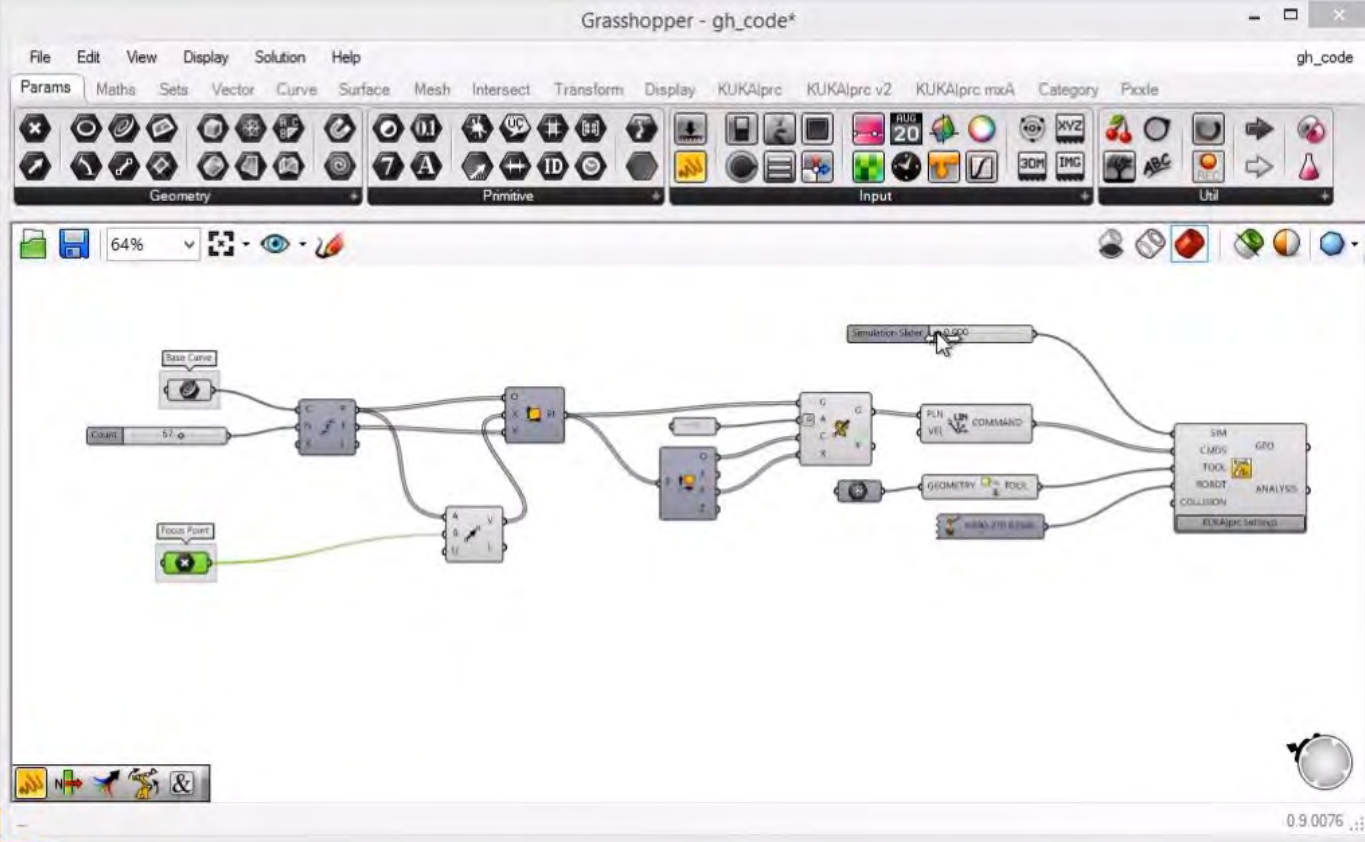
visual programming





CAD / 3D visualization




Grasshopper - gh_code*
File Edit View Display Solution Help
gh_code
Params Maths Sets Vector Curve Surface Mesh Intersect Transform Display KUKAprc KUKAprc v2 KUKAprc mxA Category Pixie
Geometry
Primitive
Input
Util
64%
Base Curve
Count
Focus Point
COMMAND
GEOMETRY
TOOL
ANALYSIS
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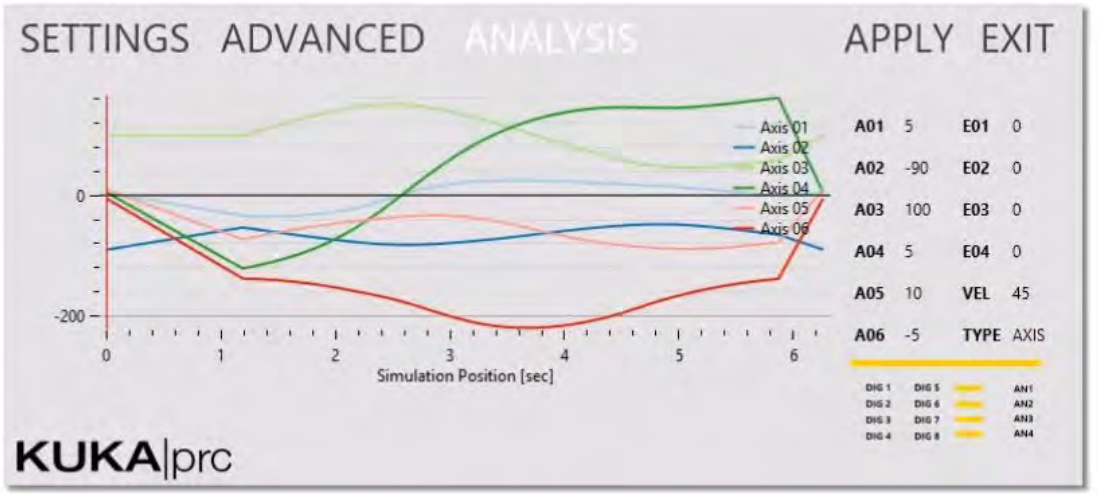
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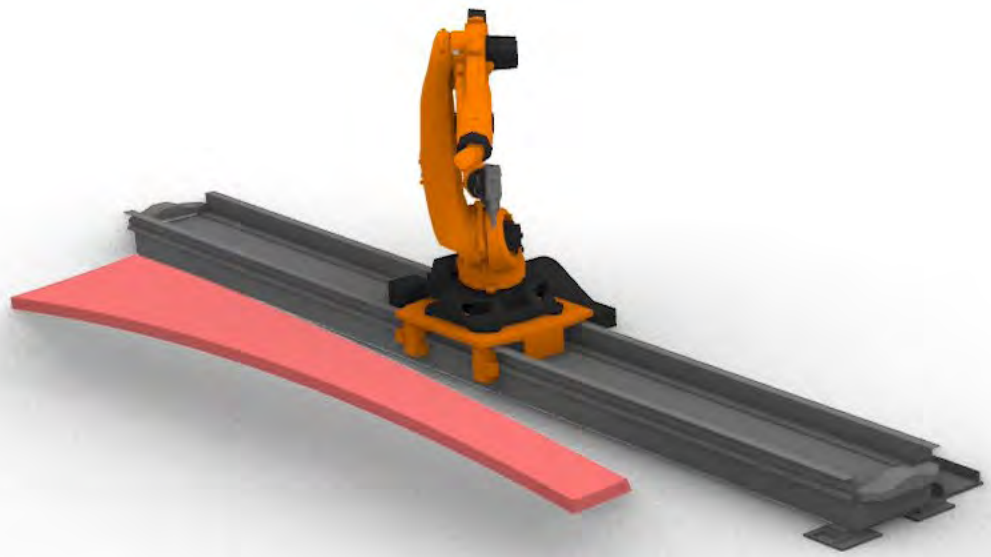
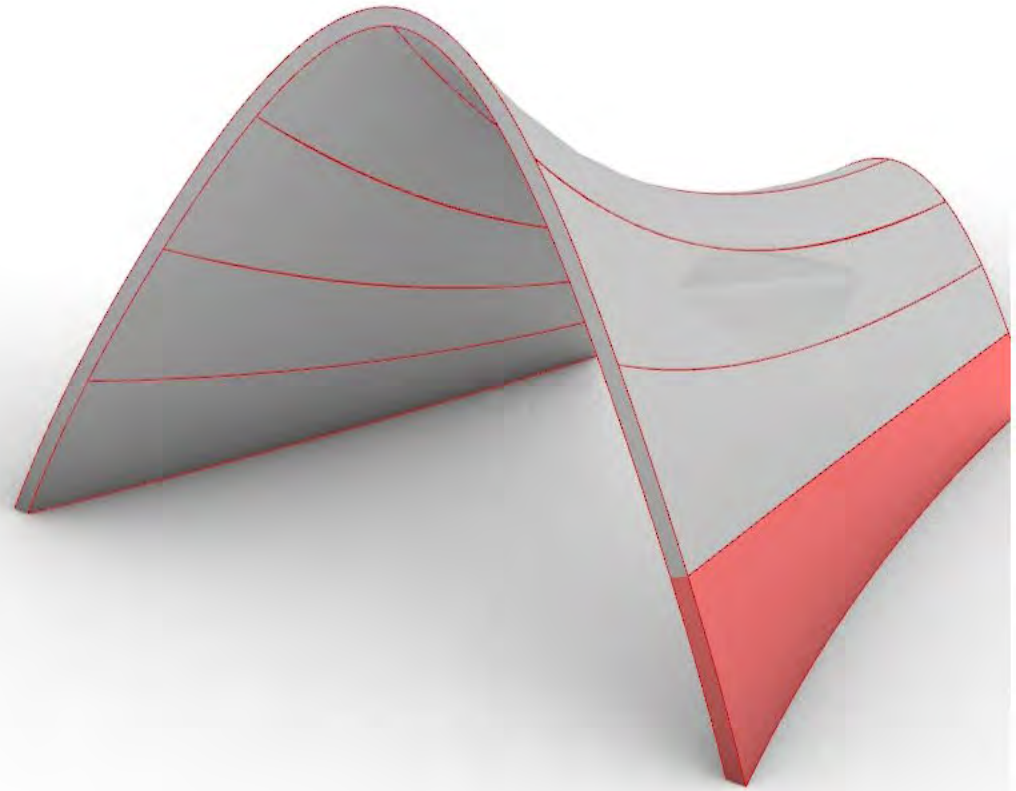
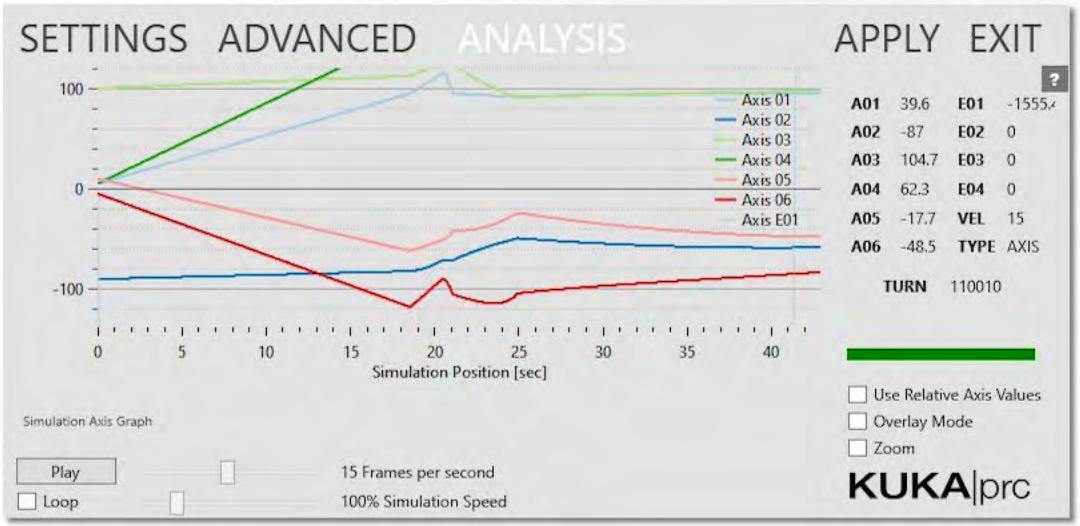
APPLY EXIT
Axis 01
Axis 02
Axis 03
Axis 04
Axis 05
Axis 06
0
-200
0 1 2 3 4 5 6
Simulation Position [sec]
A01 5
A02 -90
A03 100
A04 5
A05 10
A06 -5
E01 0
E02 0
E03 0
E04 0
VEL 45
TYPE AXIS
KUKA|prc






SETTINGS ADVANCED ANALYSIS
APPLY EXIT
100
0
-100
0 5 10 15 20 25 30 35 40
Simulation Position [sec]
Axis 01
Axis 02
Axis 03
Axis 04
Axis 05
Axis 06
Axis E01
A01 39.6 E01 -1555.
A02 -87 E02 0
A03 104.7 E03 0
A04 62.3 E04 0
A05 -17.7 VEL 15
A06 -48.5 TYPE AXIS
TURN 110010
Use Relative Axis Values
Overlay Mode
Zoom
Simulation Axis Graph
Play
Loop
15 Frames per second
100% Simulation Speed
KUKA|prc

Mixed Reality

Browser

CAD Environment

KUKA|prc
parametric robot control

New Interfaces

5G

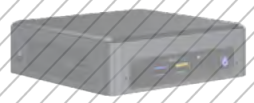
SignalR
via WebSockets

Communication Server
Locally / Cloud

Low Latency

Gateway / Server

mxAutomation
via Ethernet



Control Server

KUKA Robot

Process Intelligence


YOKAI
www.yokai-studios.com
@yokaistudios
KUKA
KUKA

creative@creative-Z690-AORUS-PRO: ~/case

0.015	150	1	5.6687742e-09	0	580.79294
0.016	160	1	6.4498053e-09	0	738.72823
0.017	170	1	7.2812255e-09	0	650.9264
0.018	180	1	8.1630349e-09	0	581.23777
0.019	190	1	9.0952333e-09	0	640.29685
0.02	200	1	1.0077821e-08	0	679.96982
0.021	210	1	1.1110797e-08	0	599.69181
0.022	220	1	1.2194163e-08	0	605.54897
0.023	230	1	1.3327918e-08	0	623.4646
0.024	240	1	1.4512062e-08	0	666.73921
0.025	250	1	1.5746595e-08	0	541.07263
0.026	260	1	1.7031517e-08	0	697.83797
0.027	270	1	1.8366828e-08	0	594.42412
0.028	280	1	1.9752529e-08	0	669.99843
0.029	290	1	2.1188618e-08	0	596.69243
0.03	300	1	2.2675097e-08	0	637.32137
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0.032	320	1	2.5799221e-08	0	667.6502
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0.036	360	1	3.2652139e-08	0	583.99174
0.037	370	1	3.4491342e-08	0	668.25283
0.038	380	1	3.6380933e-08	0	581.76463
0.039	390	1	3.8320914e-08	0	638.8817
0.04	400	1	4.0311283e-08	0	495.35263
0.041	410	1	4.2352042e-08	0	609.7487
0.042	420	1	4.444319e-08	0	490.94301
0.043	430	1	4.6584727e-08	0	669.9461
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0.045	450	1	5.1018968e-08	0	528.01321
0.046	460	1	5.3311672e-08	0	631.51662
0.047	470	1	5.5654766e-08	0	541.2545
0.048	480	1	5.8048248e-08	0	572.86305
0.049	490	1	6.049212e-08	0	488.89559
0.05	500	1	6.298638e-08	0	640.62209
0.051	510	1	6.553103e-08	0	521.86892
0.052	520	1	6.8126069e-08	0	515.25835
0.053	530	1	7.0771497e-08	0	540.10489
0.054	540	1	7.3467314e-08	0	524.57594
0.055	550	1	7.621352e-08	0	643.3872
0.056	560	1	7.9010115e-08	0	495.06142
0.057	570	1	8.18571e-08	0	613.57041
0.058	580	1	8.4754473e-08	0	658.5565
0.059	590	1	8.7702236e-08	0	461.57616
0.06	600	1	9.0700387e-08	0	584.48817
0.061	610	1	9.3748928e-08	0	572.42734
0.062	620	1	9.6847858e-08	0	708.9388
0.063	630	1	9.9997177e-08	0	498.61435
0.064	640	1	1.0319689e-07	0	593.72569
0.065	650	1	1.0644698e-07	0	482.83607
0.066	660	1	1.0974747e-07	0	630.14406
0.067	670	1	1.1309834e-07	0	663.69984
0.068	680	1	1.1649961e-07	0	523.84051
0.069	690	1	1.1995126e-07	0	594.64048
0.07	700	1	1.2345331e-07	0	583.79468
0.071	710	1	1.2700574e-07	0	879.82636
0.072	720	1	1.3060856e-07	0	1705.1232
0.073	730	1	1.3426177e-07	0	767.22218
0.074	740	1	1.3796537e-07	0	1710.5248
0.075	750	1	1.4171936e-07	0	1017.4507
0.076	760	1	1.4552373e-07	0	1291.0869
0.077	770	1	1.493785e-07	0	837.32002
0.078	780	1	1.5328365e-07	0	1475.9052
0.079	790	1	1.572392e-07	0	791.77147
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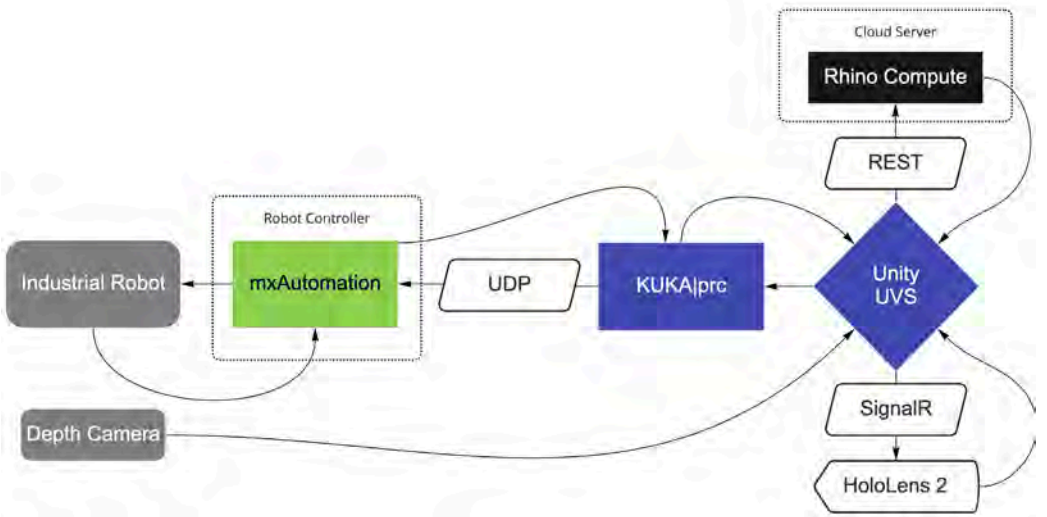
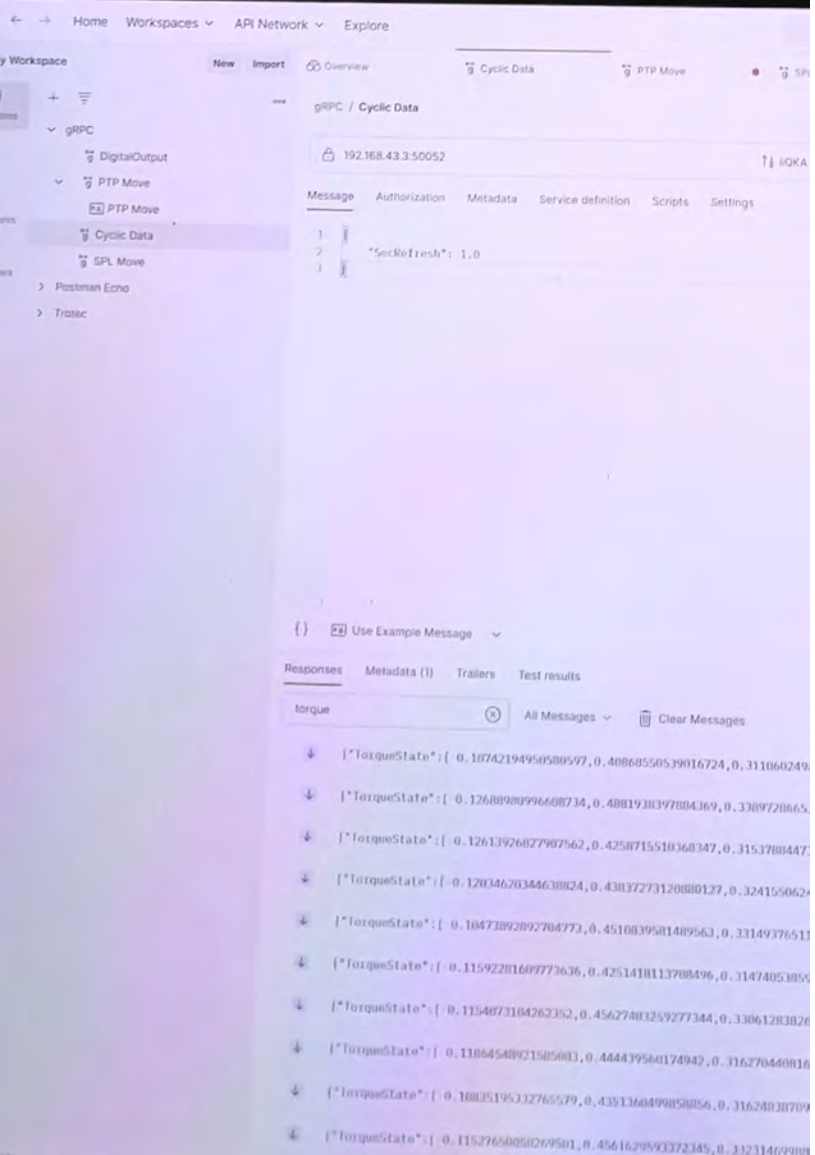
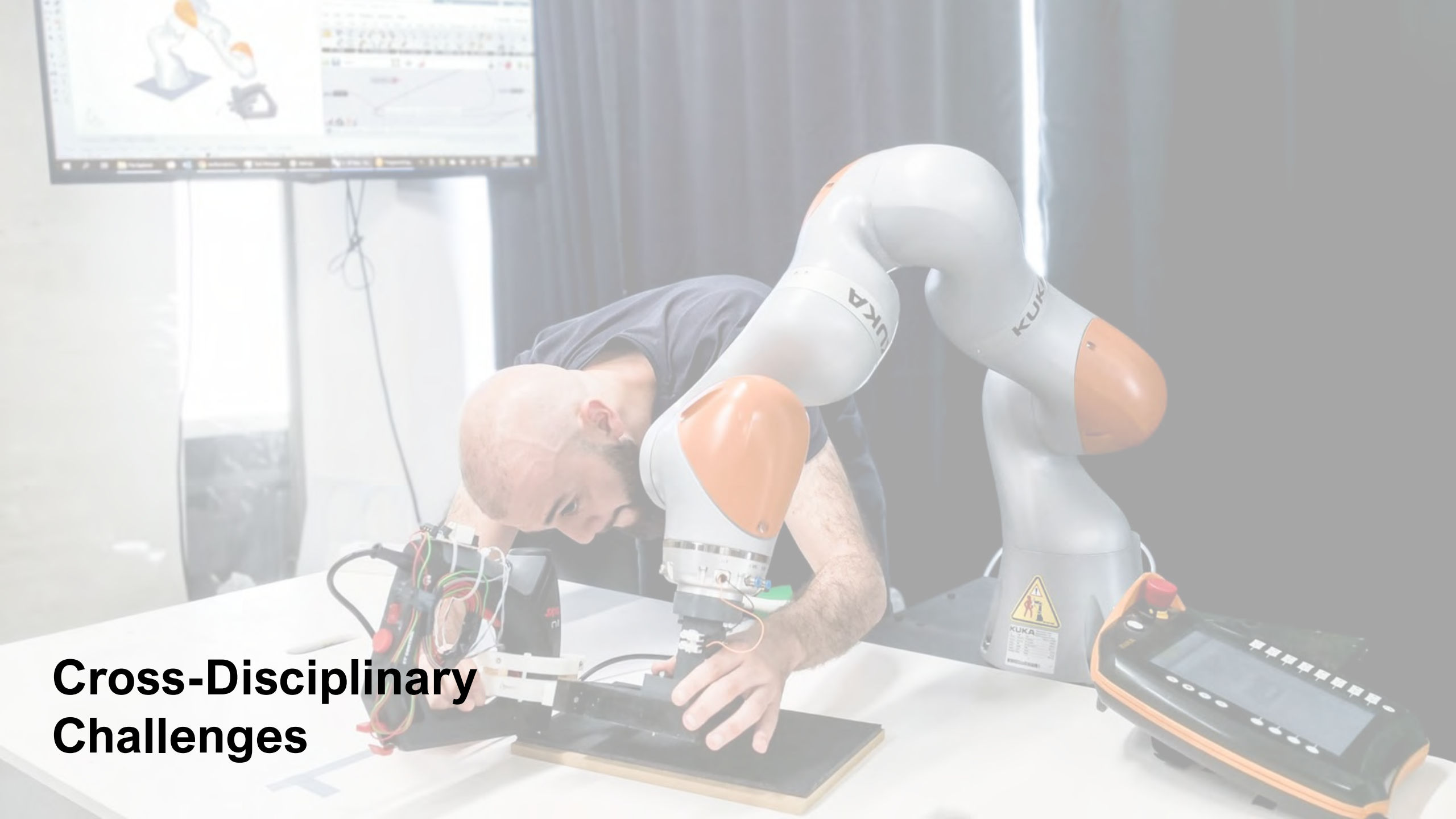
0.082	820	1	1.6940817e-07	0	1623.3627
0.083	830	1	1.7356527e-07	0	804.83571
0.084	840	1	1.7777276e-07	0	1354.0743
0.085	850	1	1.8203064e-07	0	1305.4218
0.086	860	1	1.8633891e-07	0	816.59151
0.087	870	1	1.9069756e-07	0	761.81839
0.088	880	1	1.9510661e-07	0	747.66607

DCS COMPUTING


Cloud Server
Rhino Compute
REST
Robot Controller
Industrial Robot
mxAutomation
UDP
KUKA|prc
Unity
UVS
SignalR
Depth Camera
HoloLens 2


Home
Workspaces
API Network
Explore
New
Import
Overview
Cyclic Data
PTP Move
gRPC / Cyclic Data
gRPC
DigitalOutput
PTP Move
PTP Move
Cyclic Data
SPL Move
Postman Echo
Trotec
192.168.43.3:50052
iiQKA
Message
Authorization
Metadata
Service definition
Scripts
Settings
{
"SecRefresh": 1.0
}
Use Example Message
Responses
Metadata (1)
Trailers
Test results
torque
All Messages
Clear Messages


LBR iisy
KUKA
Scene
3D VISUALIZATION
PARAMETERS
Type
Robot
Name
Coordinates
Parent
World



Cross-Disciplinary Challenges

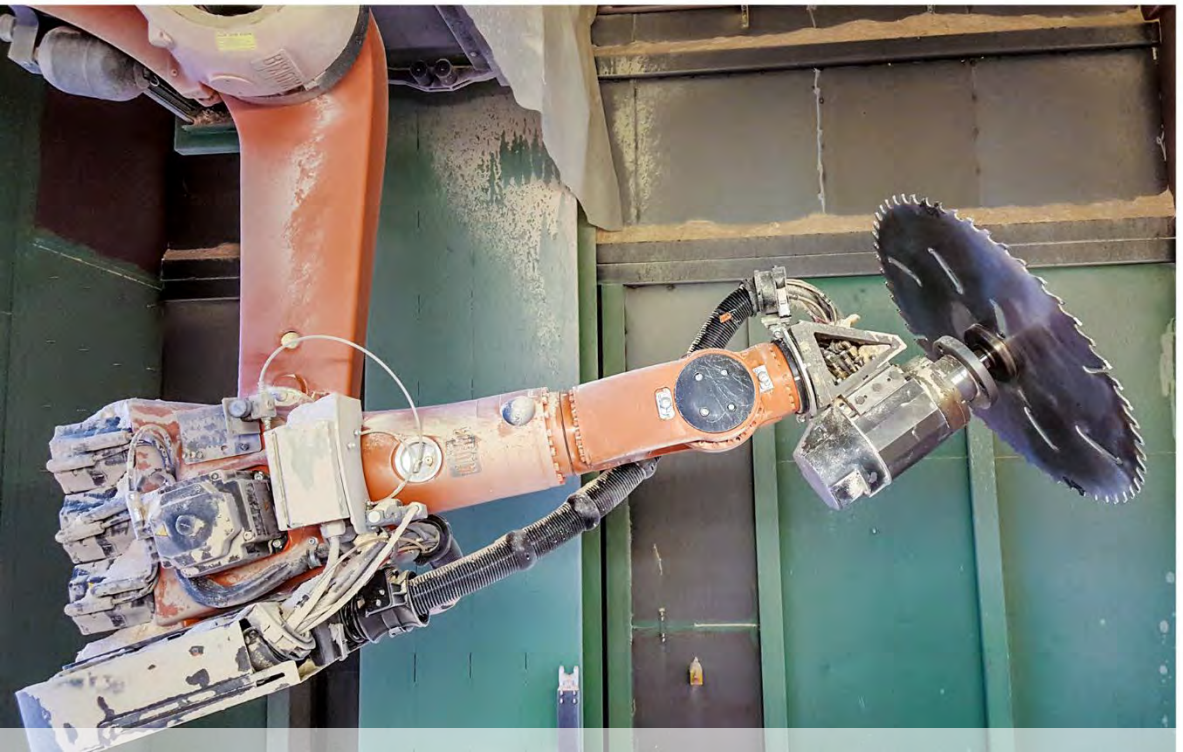


Image: Merk


KUKA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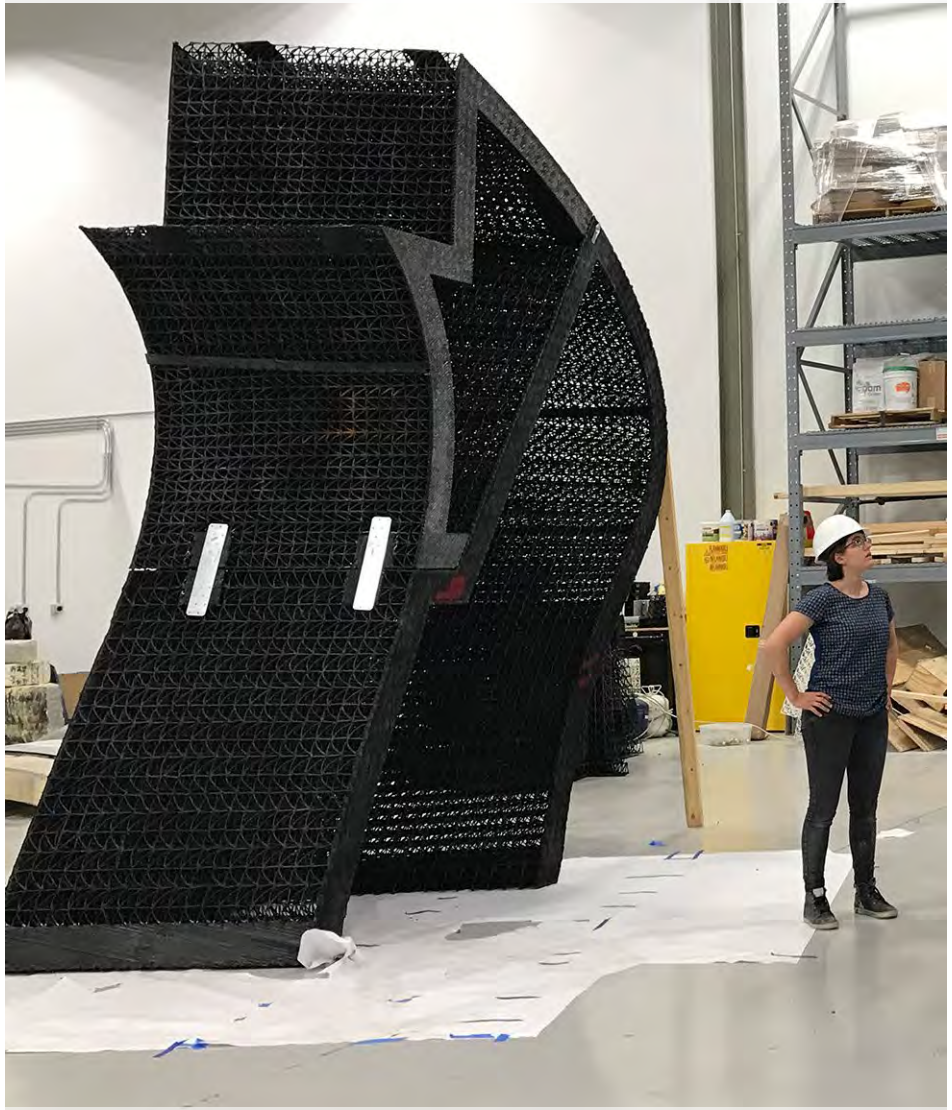
KUKA
FREidee®

Image: Aeditive

Branch
TECHNOLOGY



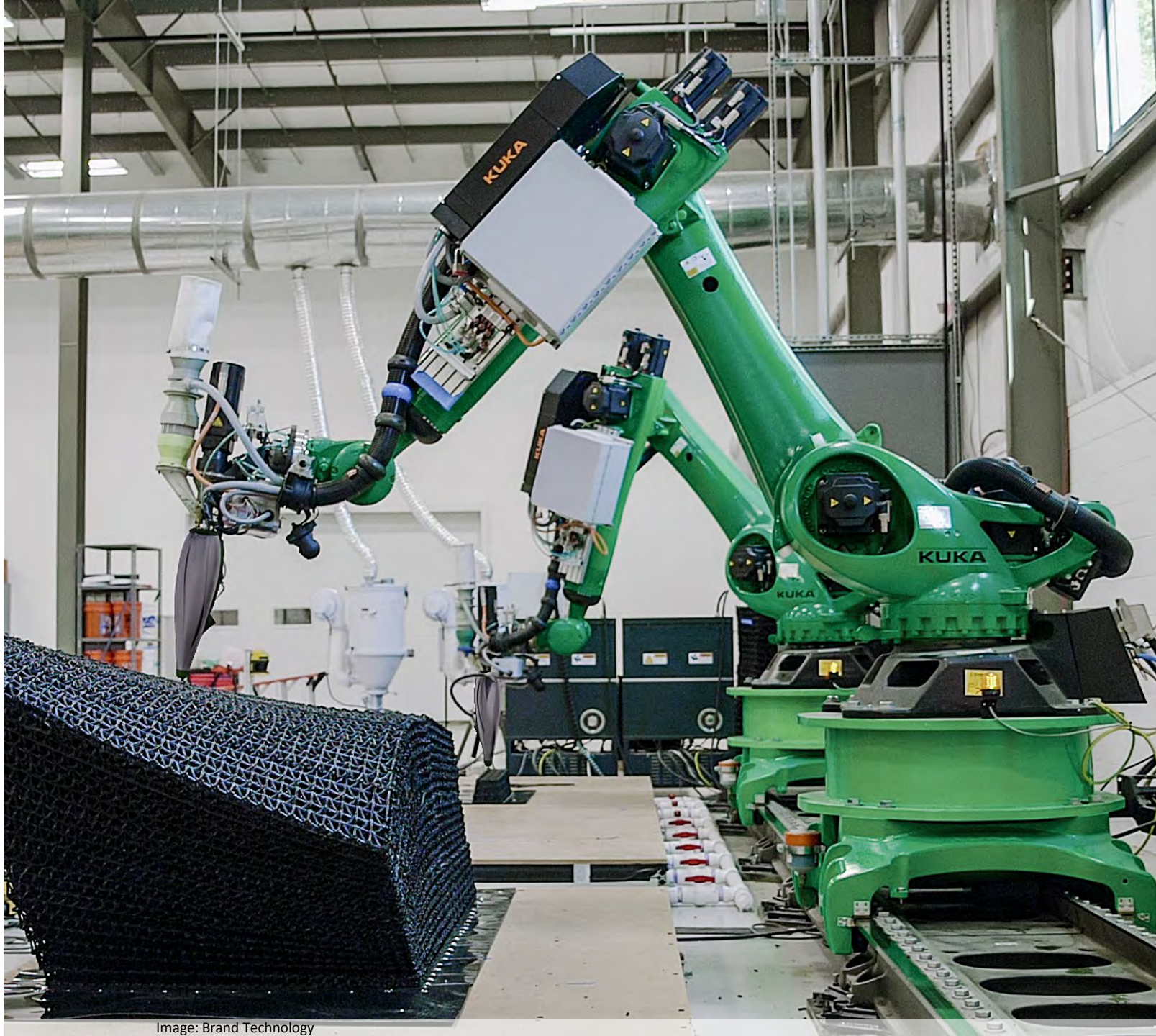
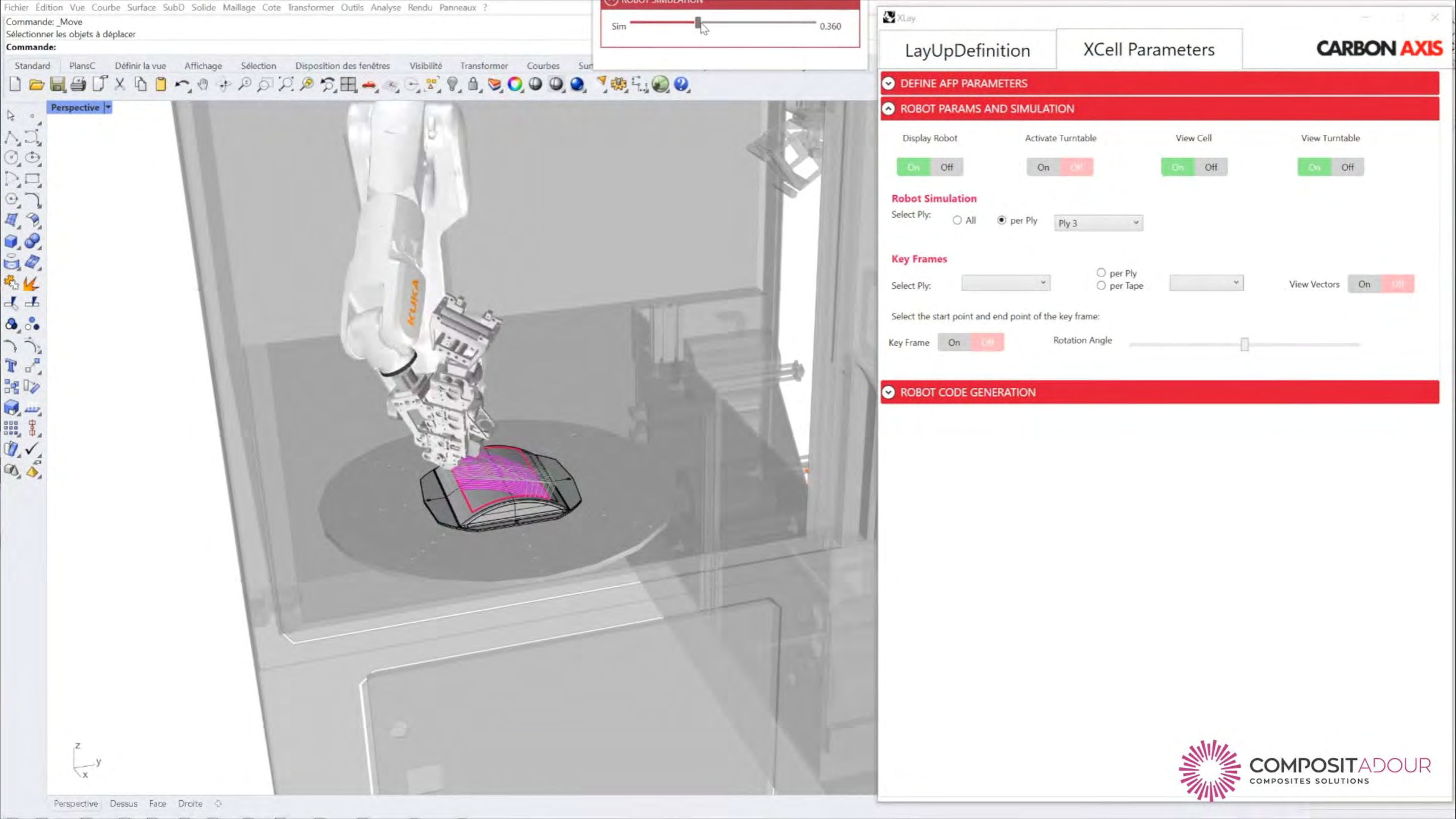


Image: Brand Technology

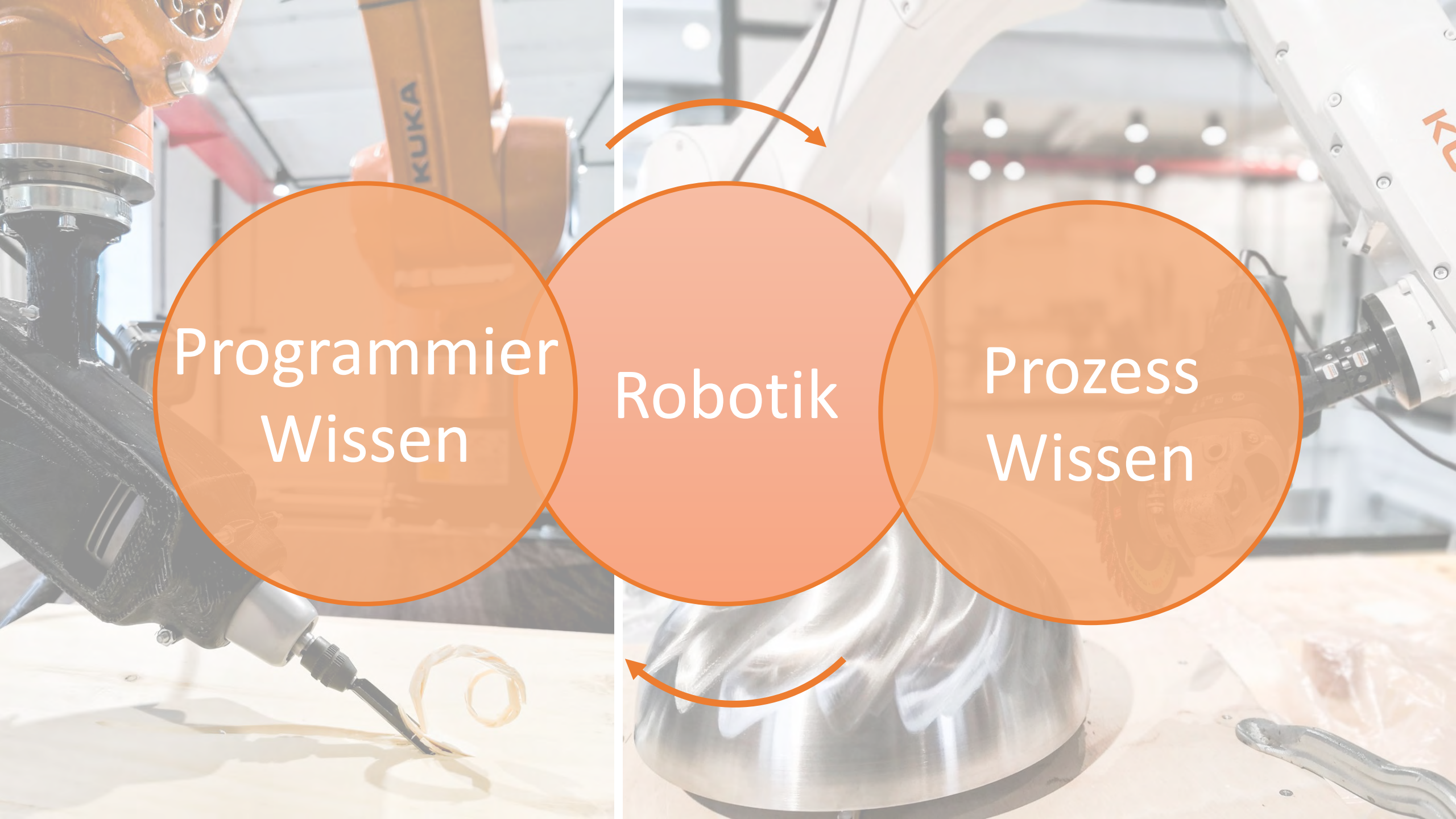

Relativity
Relativity


Fichier Édition Vue Courbe Surface SubD Solide Maillage Cote Transformer Outils Analyse Rendu Panneaux ?
Commande: _Move
Sélectionner les objets à déplacer
Commande:
Standard PlansC Définir la vue Affichage Sélection Disposition des fenêtres Visibilité Transformer Courbes
Perspective
Sim
0.360
XLay
LayUpDefinition
XCell Parameters
CARBON AXIS
DEFINE AFP PARAMETERS
ROBOT PARAMS AND SIMULATION
Display Robot
Activate Turntable
View Cell
View Turntable
On
Off
Robot Simulation
Select Ply:
All
per Ply
Ply 3
Key Frames
Select Ply:
per Ply
per Tape
View Vectors
Select the start point and end point of the key frame:
Key Frame
Rotation Angle
ROBOT CODE GENERATION
COMPOSITADOUR
COMPOSITES SOLUTIONS
Perspective Dessus Face Droite

CREATIVE ROBOTICS

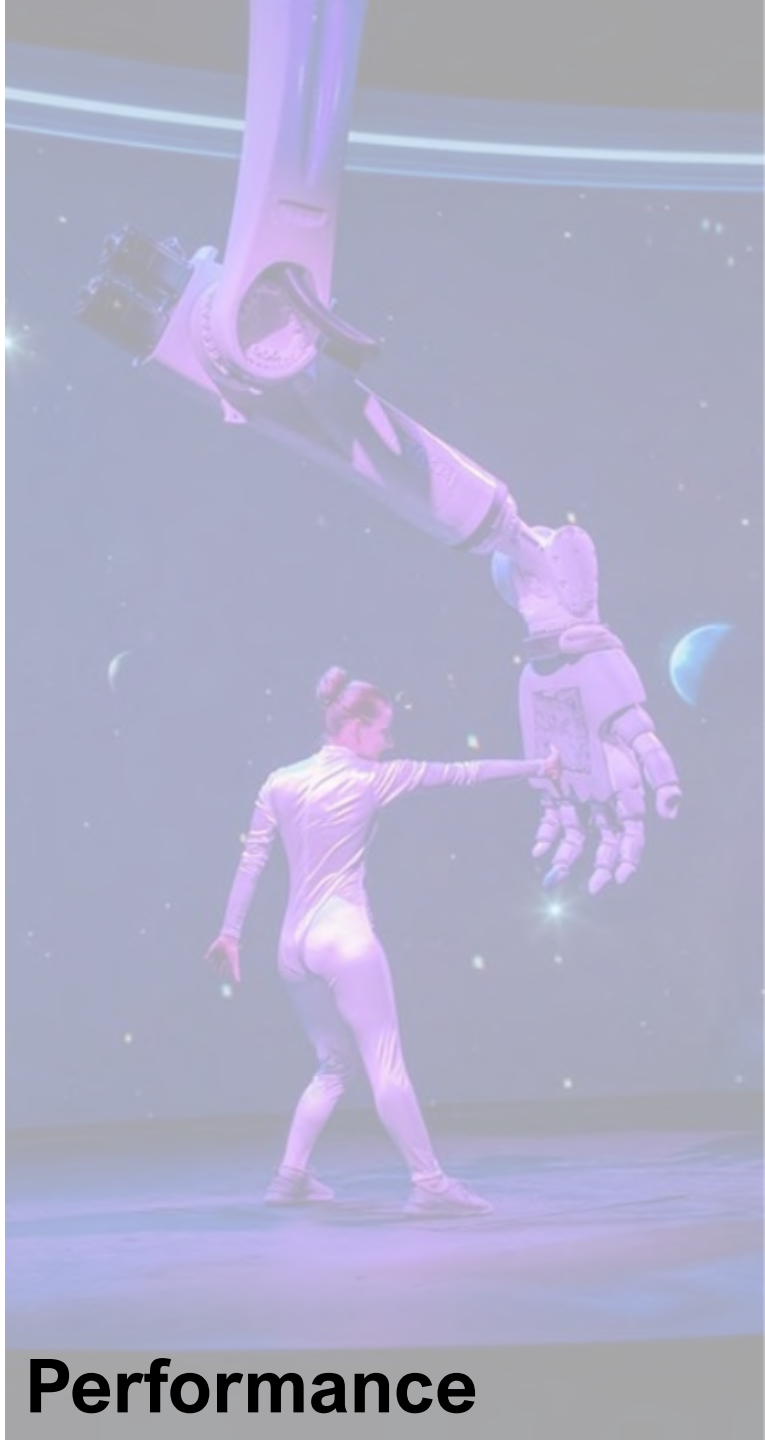
Digitale Daten > CREATIVE ROBOTICS **> Physische Welt**

Robotik

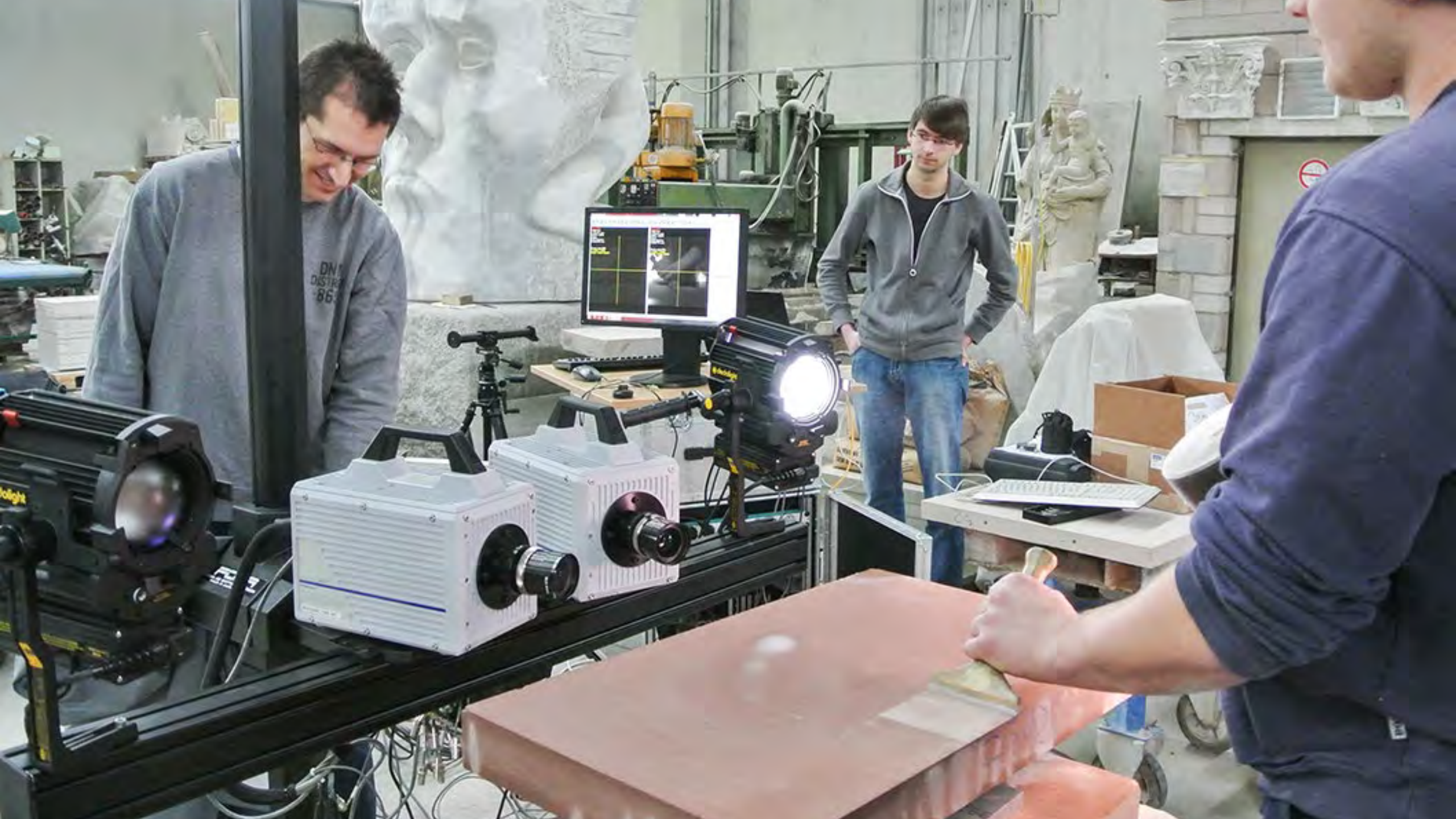

Programmier
Wissen
Robotik
Prozess
Wissen

Startups / KMUs

Handwerk



Performance

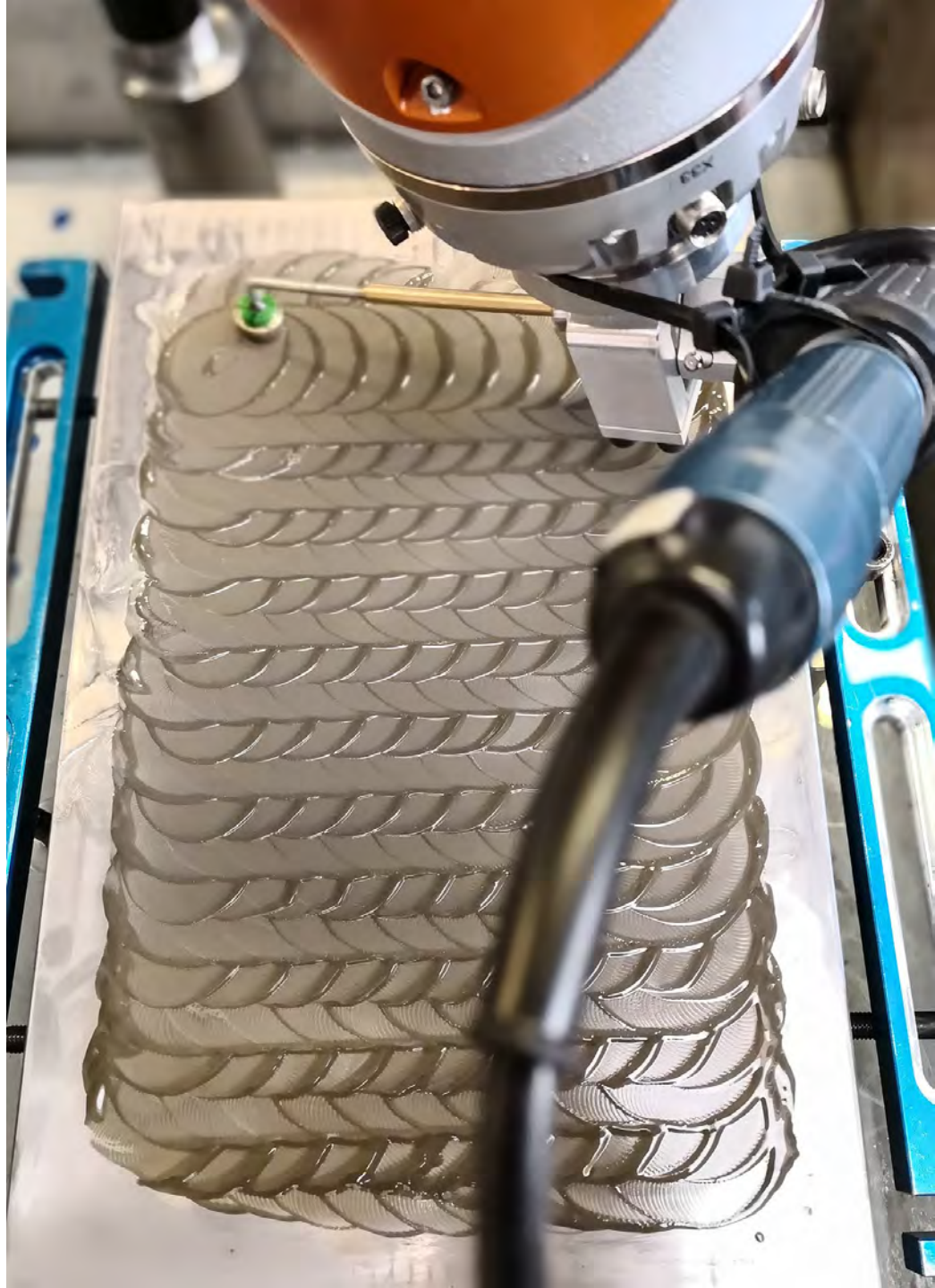


measuring the force and exact movement of several manual structuring processes

Image: Robots in Architecture / AROSU

combined, AROSU allows stone structures that would not be possible with manual structuring

Image: Robots in Architecture / AROSU

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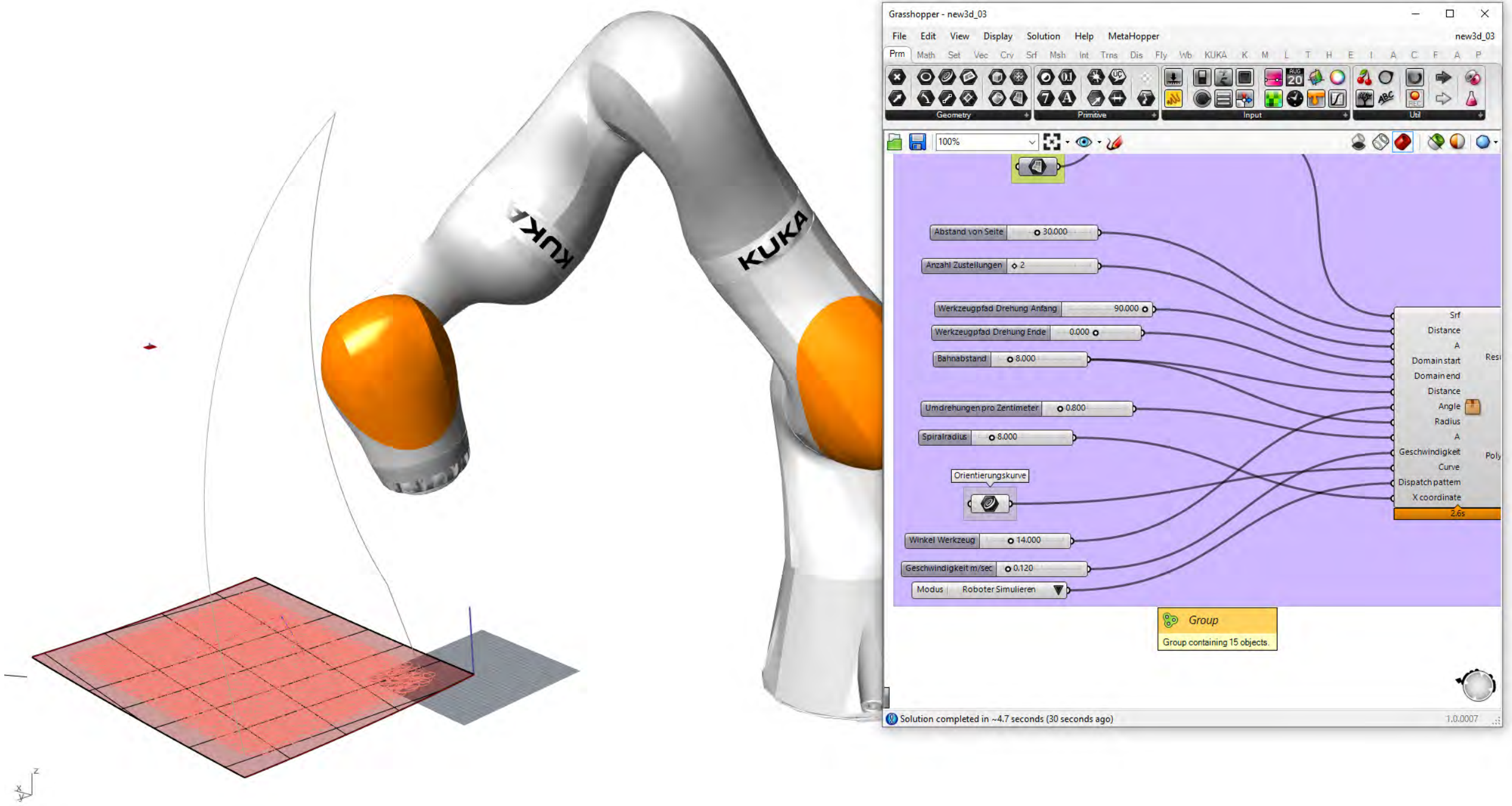
Grasshopper - new3d_03
File Edit View Display Solution Help MetaHopper
new3d_03
Prm Math Set Vec Crv Srf Msh Int Trns Dis Fly Wb KUKA K M L T H E I A C F A P
Geometry
Primitive
Input
Util
100%
Abstand von Seite 30.000
Anzahl Zustellungen 2
Werkzeugpfad Drehung Anfang 90.000
Werkzeugpfad Drehung Ende 0.000
Bahnabstand 8.000
Umdrehungen pro Zentimeter 0.800
Spiralradius 8.000
Orientierungskurve
Winkel Werkzeug 14.000
Geschwindigkeit m/sec 0.120
Modus Roboter Simulieren
Srf
Distance
A
Domain start
Domain end
Distance
Angle
Radius
A
Geschwindigkeit
Curve
Dispatch pattern
X coordinate
2.6s
Resi
Poly
Group
Group containing 15 objects.
Solution completed in ~4.7 seconds (30 seconds ago)
1.0.0007
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KUKA

Fashion Robotics

kunst
universität
linz

JOHANNES KEPLER
UNIVERSITÄT LINZ

FWF
Der Wissenschaftsfonds.

Growing Whole Garments, Ars Electronica Center Incubator, 2021


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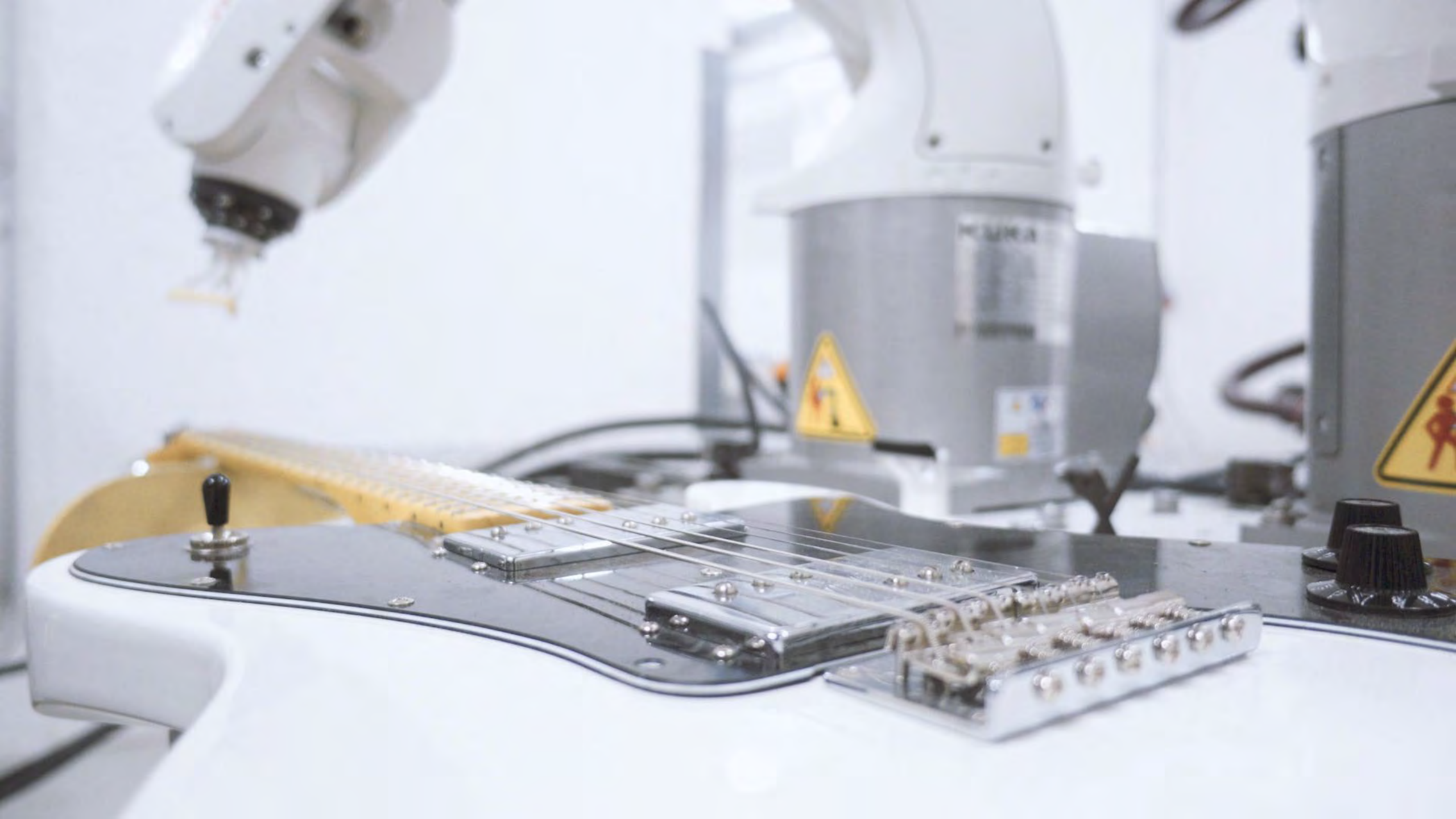
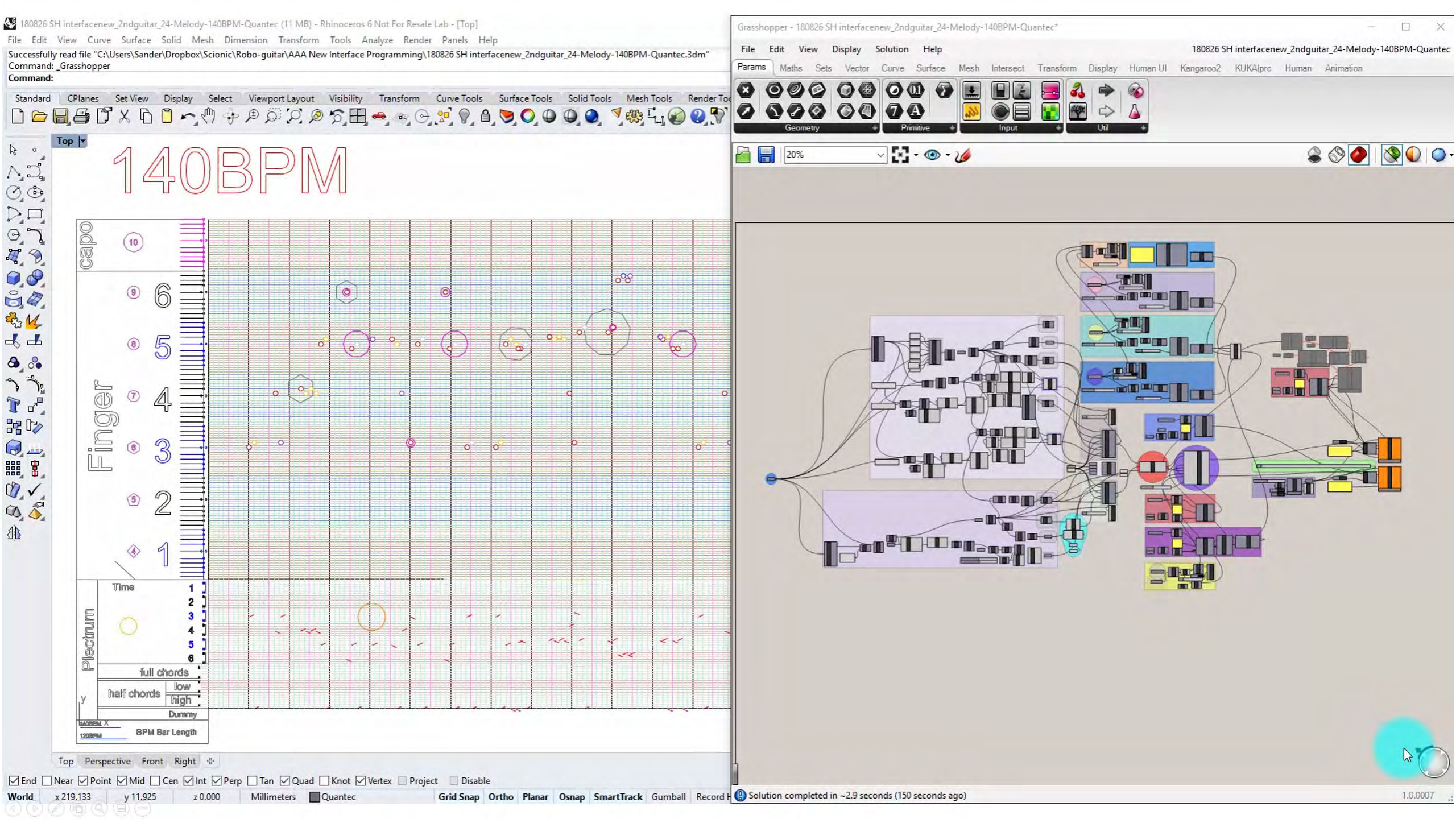
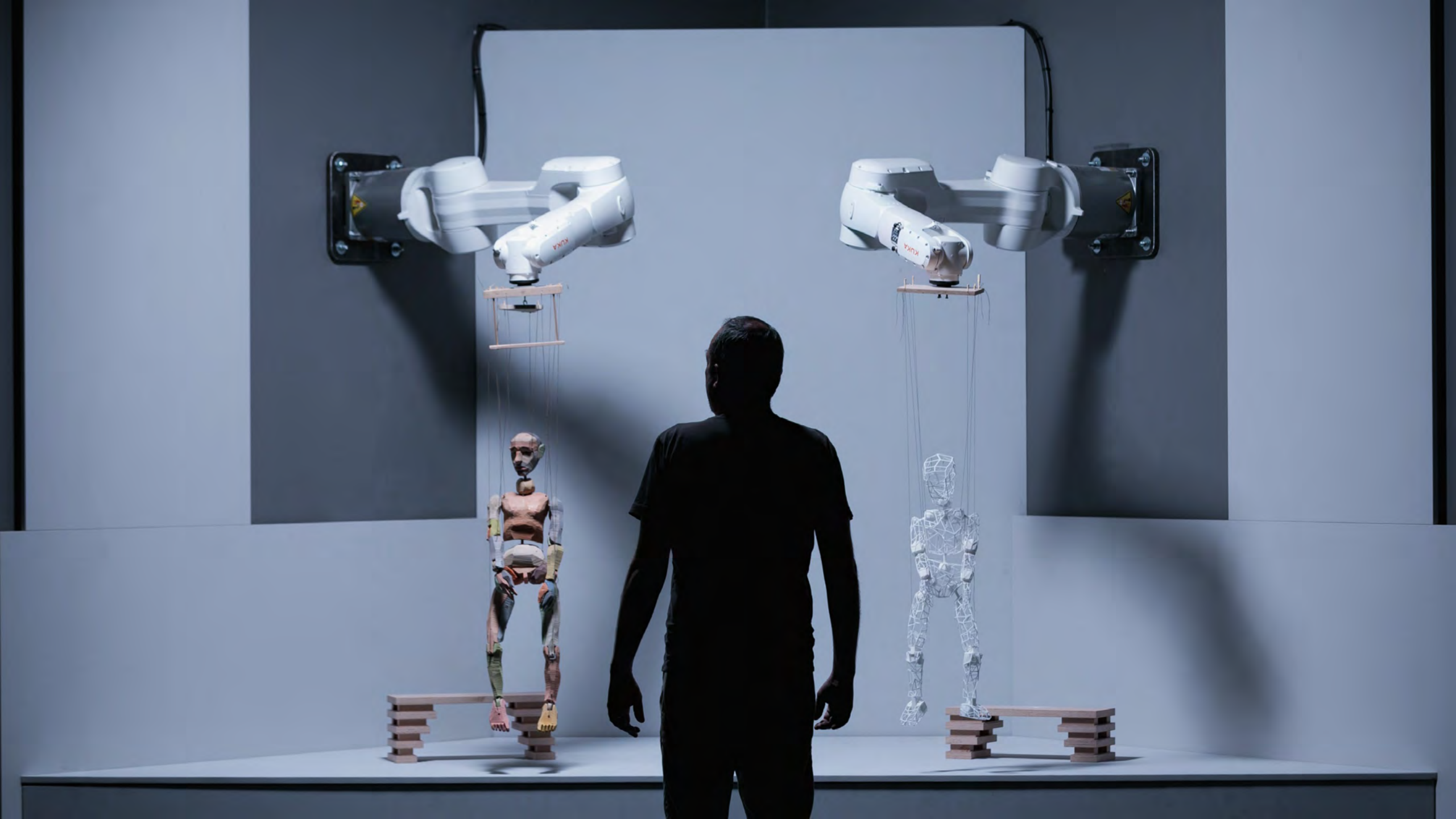



180826 SH interfacenew_2ndguitar_24-Melody-140BPM-Quantec (11 MB) - Rhinoceros 6 Not For Resale Lab - [Top]
File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels Help
Successfully read file "C:\Users\Sander\Dropbox\Scionic\Robo-guitar\AAA New Interface Programming\180826 SH interfacenew_2ndguitar_24-Melody-140BPM-Quantec.3dm"
Command: _Grasshopper
Command:
Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools Mesh Tools
Top
140BPM
capo
10
9
6
8
5
7
4
6
3
5
2
4
1
Finger
Time
1
2
3
4
5
6
Plectrum
full chords
half chords
low
high
y
Dummy
BPM Bar Length
Top Perspective Front Right
End Near Point Mid Cen Int Perp Tan Quad Knot Vertex Project Disable
World x 219.133 y 11.925 z 0.000 Millimeters Quantec Grid Snap Ortho Planar Osnap SmartTrack Gumball Record H
Grasshopper - 180826 SH interfacenew_2ndguitar_24-Melody-140BPM-Quantec*
File Edit View Display Solution Help
180826 SH interfacenew_2ndguitar_24-Melody-140BPM-Quantec
Params Maths Sets Vector Curve Surface Mesh Intersect Transform Display Human UI Kangaroo2 KUKAprc Human Animation
Geometry
Primitive
Input
Util
20%
Solution completed in ~2.9 seconds (150 seconds ago)
1.0.0007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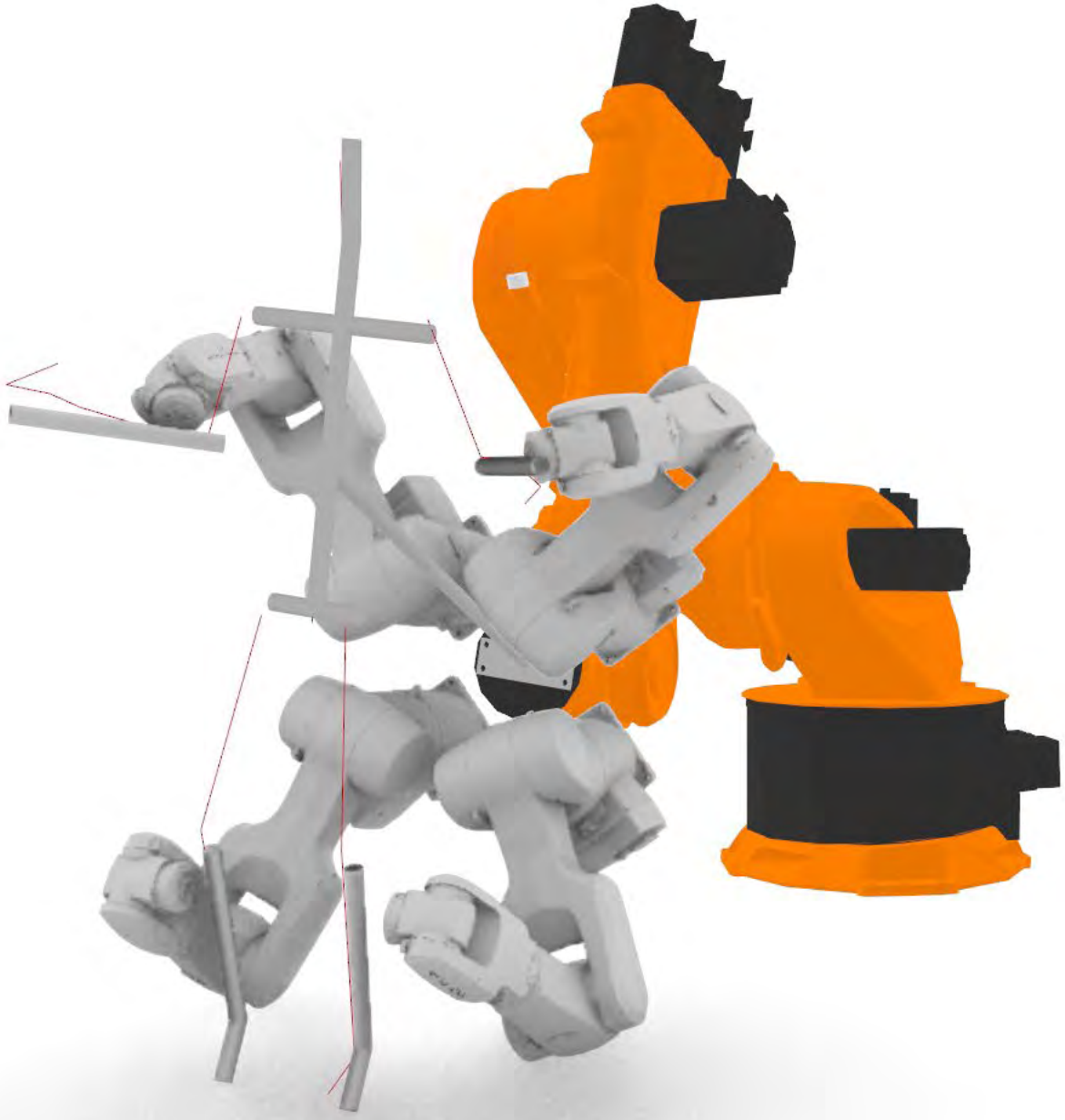


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BULLEIT
BOURBON
FRONTIER WHISKEY

ROB|ARCH 2024

Robotic Fabrication in Architecture, Art, and Design

Association for
Robots in Architecture

https://robotsinarchitecture.org/

Workshops: May 21-23, 2024
Conference: May 24-25, 2024

Registration Information Coming Soon!

ROB|ARCH 2024 reflects on the shifts within and outside the discipline that continue to unfold since the last time we had a chance to meet in 2018. The conference will center new ways, methods, and contexts of practicing with technology that have emerged. In reflecting on the new developments, we will focus on identifying potential futures of technological creative practices.

CREATIVE ROBOTICS

Vielen Dank!

johannes@robotsinarchitecture.org