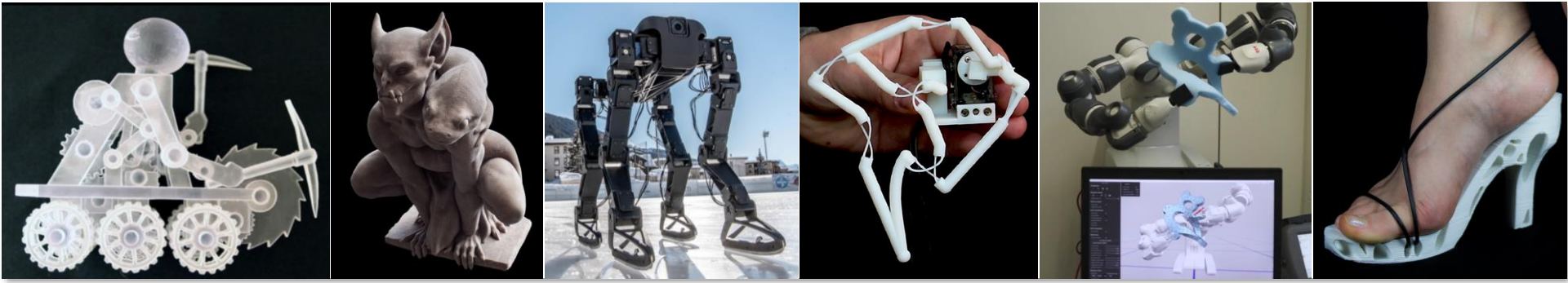
Physics-based Modeling for Computational Fabrication and Robotics



Prof. Dr. Stelian Coros

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Course Instructors

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Dr. Kristina Shea
(D-MAVT)

Dr. Moritz Bächer
(Disney Research)

Moritz Geilinger
TA

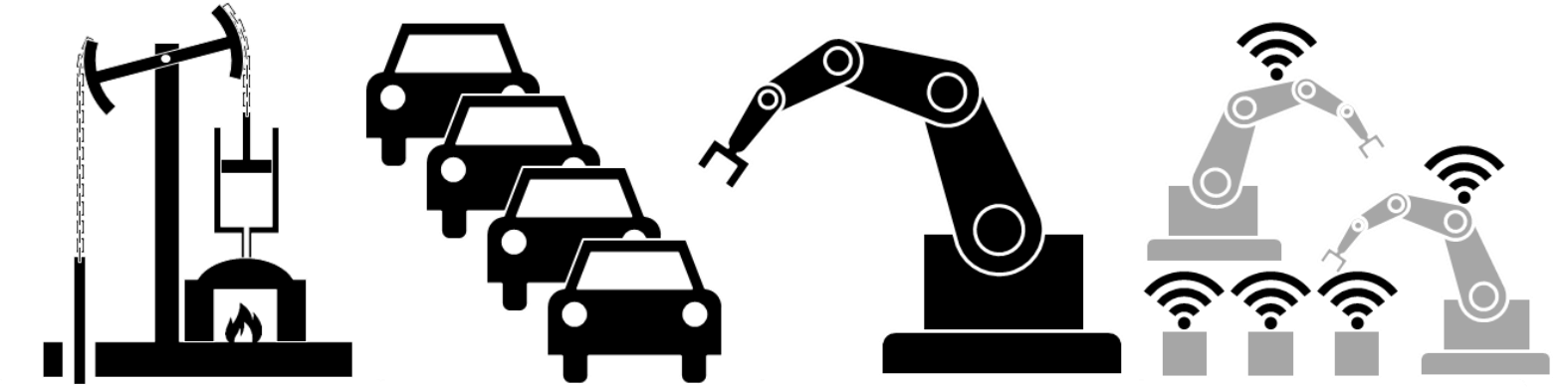
What this course is about…

Physics-based Modeling for Computational Fabrication and Robotics

The context: Industry 4.0

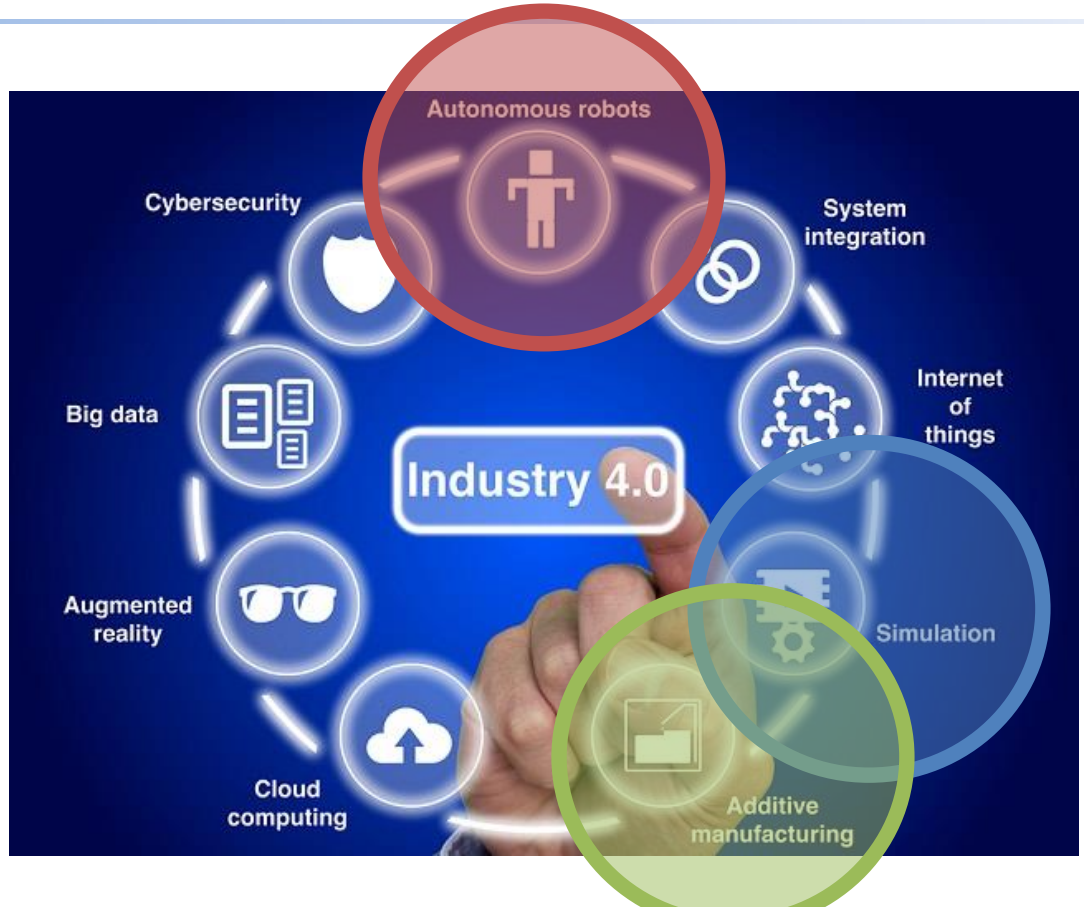
The future of manufacturing is digital!

The context: Industry 4.0

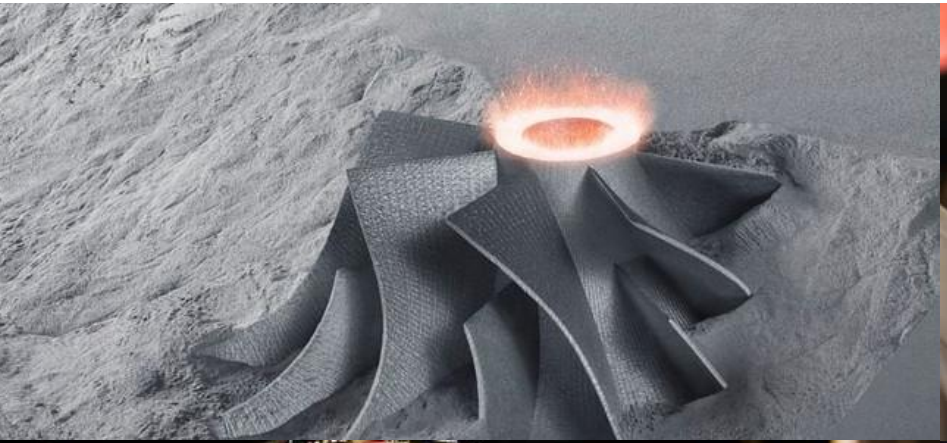


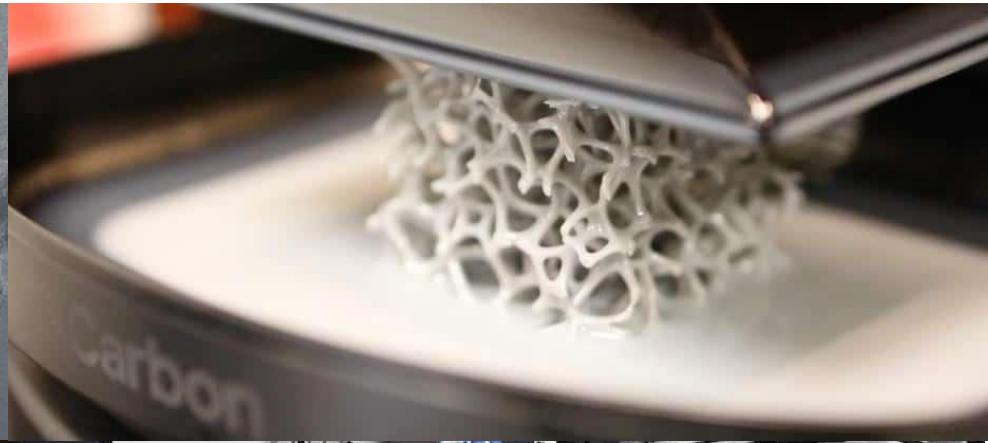
1st	2nd	3rd	4th
Mechanization, water power, steam power	Mass production, assembly line, electricity	Computer and automation	Autonomous systems and the Smart Factory

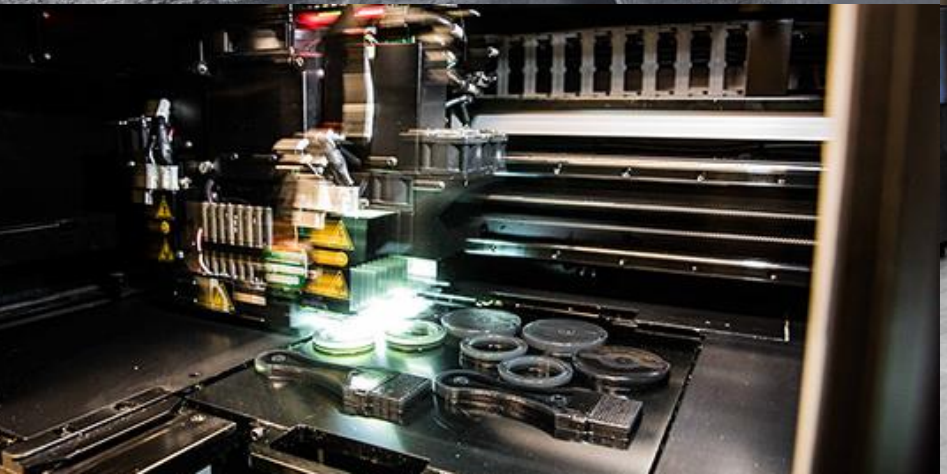
The context: Industry 4.0



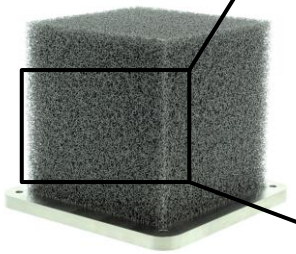
Additive Manufacturing

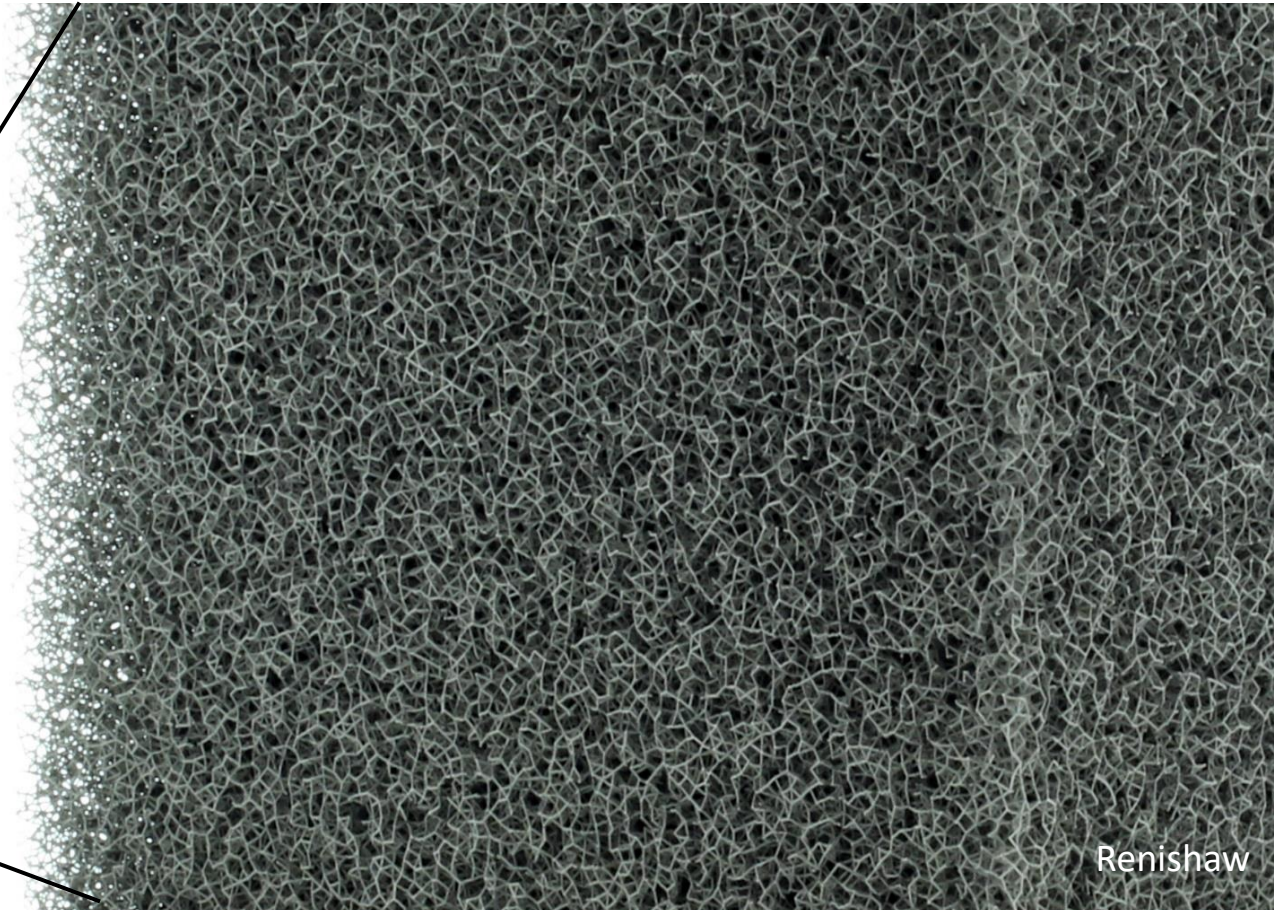






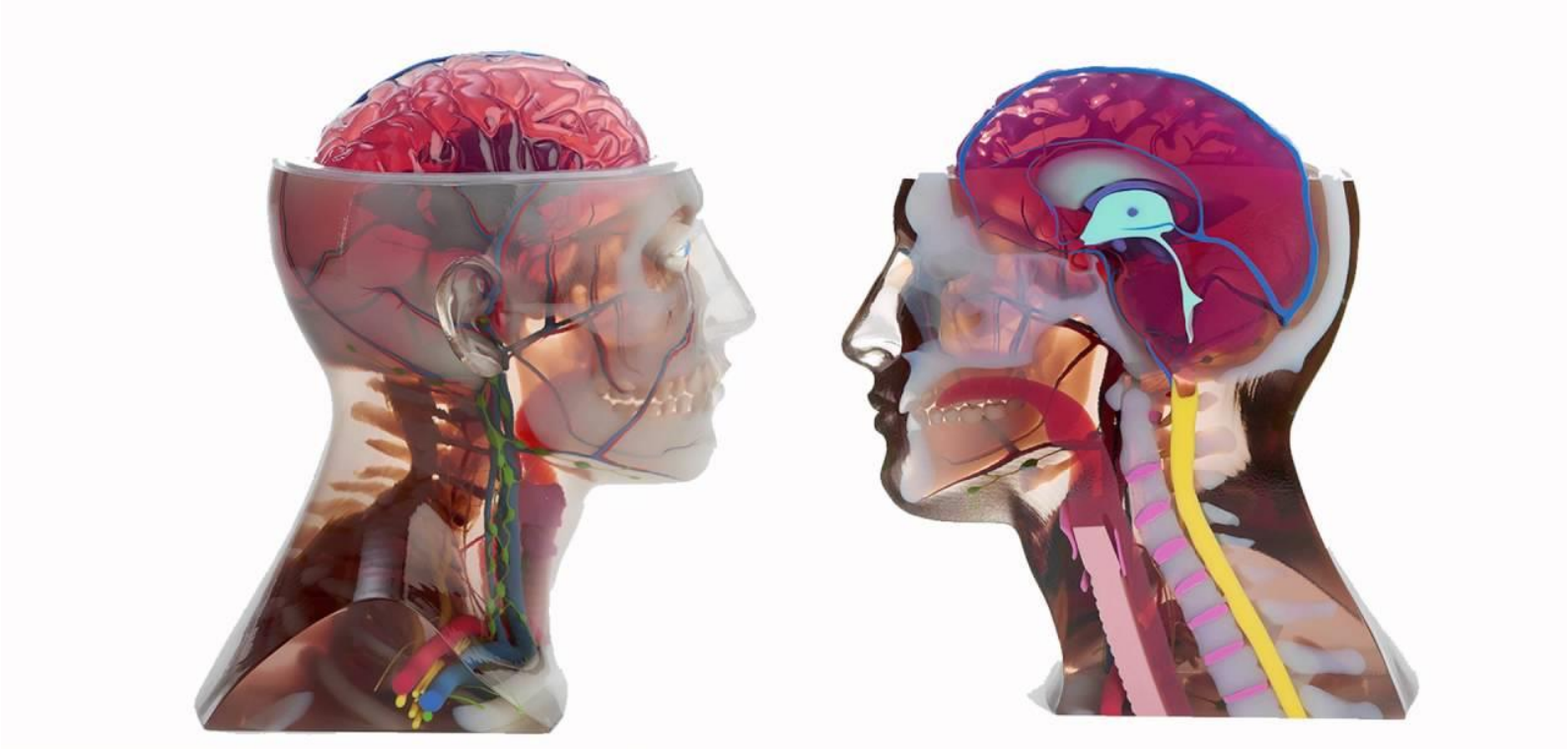
AM: Geometric complexity





Renishaw

AM: Multi-material capabilities



AM: a shift from mass production to mass personalization

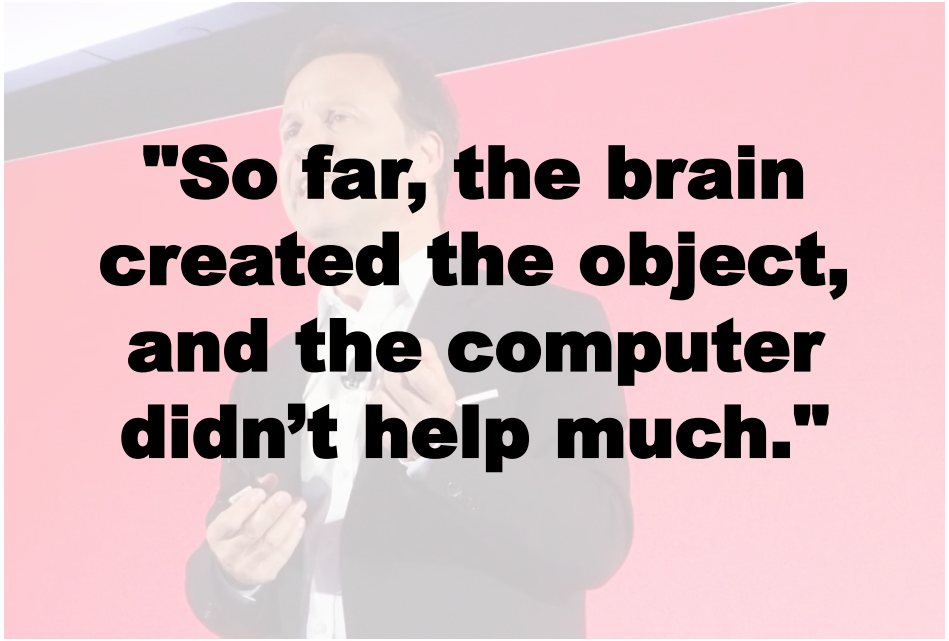
Computational Fabrication

Grand Challenge: mastering the complexity enabled by digital manufacturing

- new opportunities, new challenges
- the gap between "what we can produce" and "what we can design" is rapidly growing
- without new software design solutions, the digitalization of manufacturing cannot go far…

The State of CAD

Carl Bass, former CEO Autodesk



Gian Paolo Bassi, CEO Solidworks


DARPA Transformative Design (TRADES) Program

Computational Fabrication

Grand Challenge: mastering the complexity enabled by digital manufacturing

- Very much an active research area
- In this course we will see how physics-based simulation models can be used as the foundation for computation-driven design

https://www.manandmachine.co.uk/complex-design-age-additive-manufacturing/

What this course is about…

Physics-based Modeling for Computational Fabrication and Robotics

AM presents fascinating opportunities for robotics

AM presents fascinating opportunities for robotics

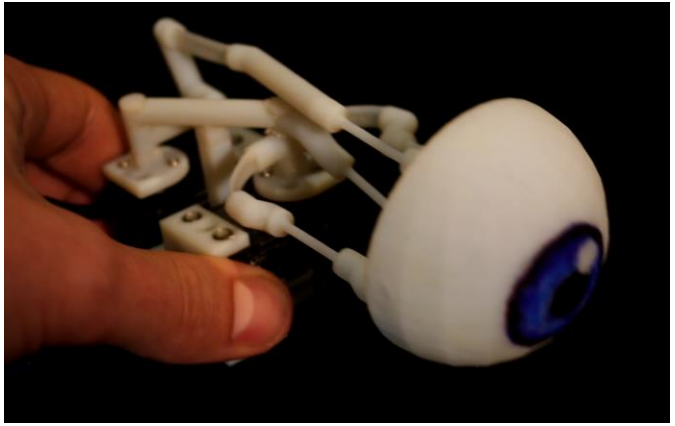
[Wu, Aage, Westermann and Sigmund, 2018]

[Image Credit: Stratasys]

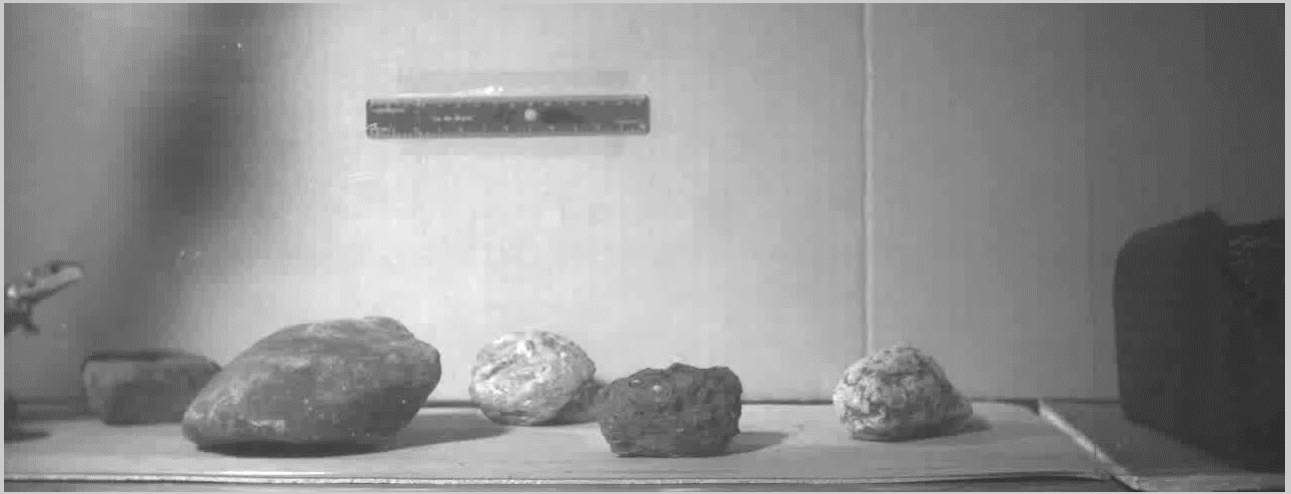
The Sci Fi vision…

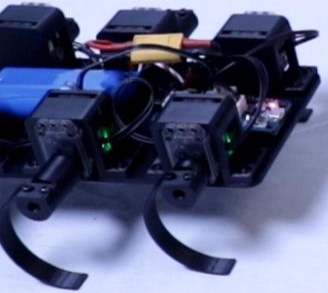
[Intro to HBO's Westworld, https://www.youtube.com/watch?v=QRi3ULhyQq0]

The Sci Fi vision…



Exciting opportunities for robotics, but also for assistive technologies – prosthetics devices, wearables, etc…





Industry 4.0

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Robotics is seen as the next big “must have”

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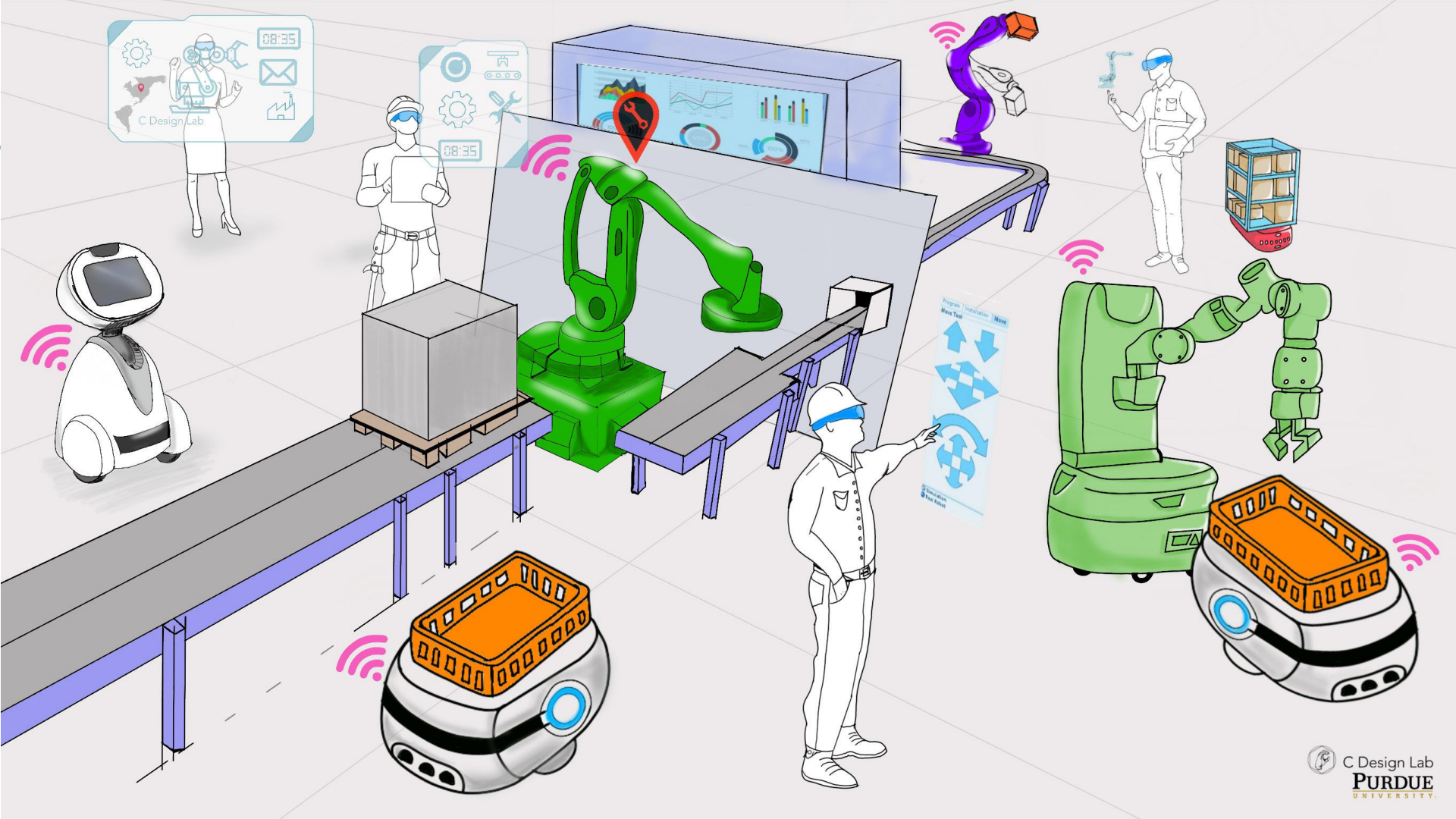
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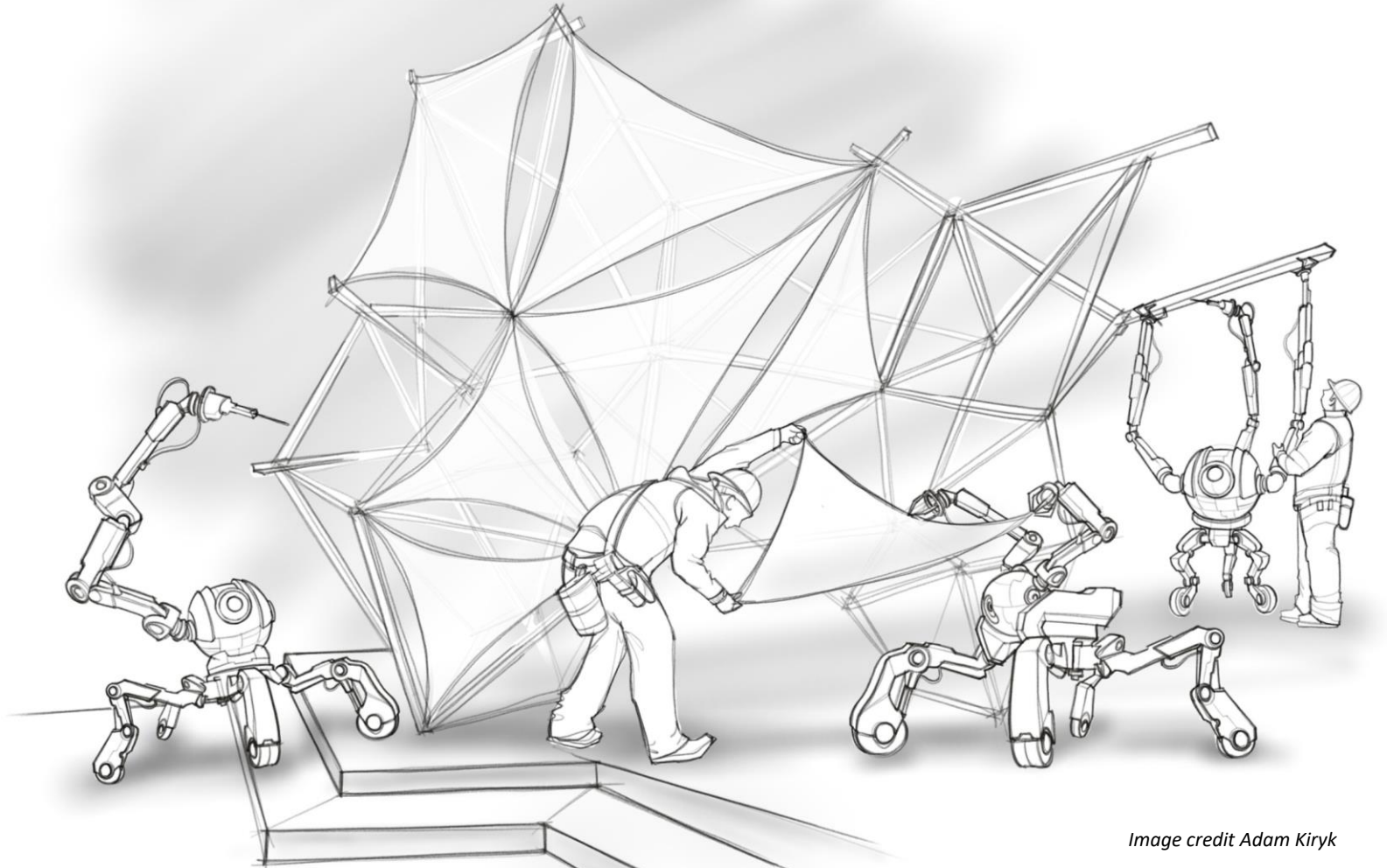


Image credit Adam Kiryk

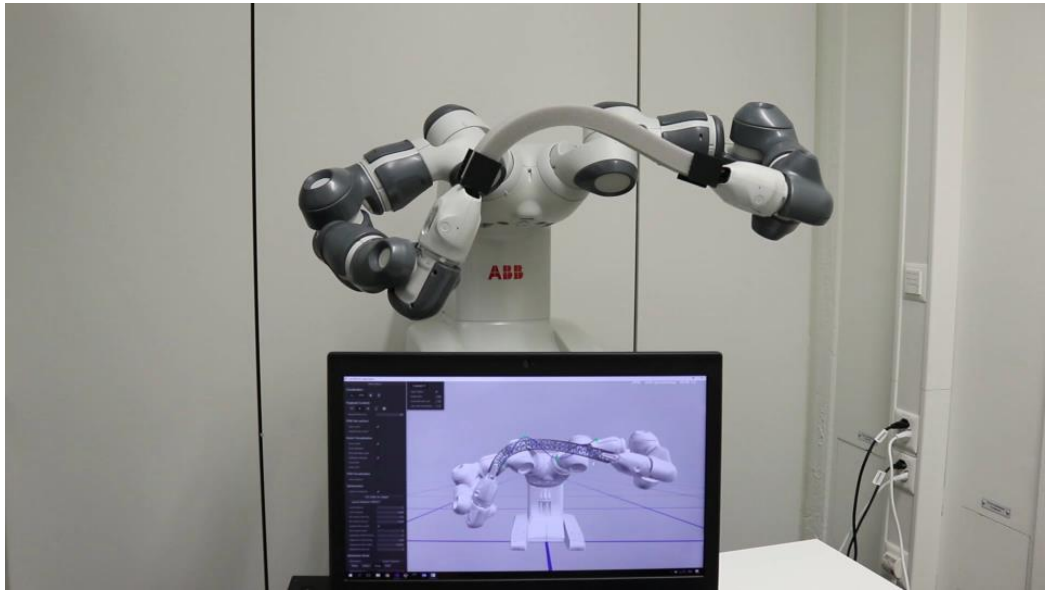
Human-level skill and dexterity…

Grand Challenge: robots must understand the physical implications of their actions

- once again, physics-based simulation models can come to the rescue…

Human-level skill and dexterity…

Grand Challenge: robots must understand the physical implications of their actions



What this course is about…

Physics-based Modeling for Computational Fabrication and Robotics

On to: course schedule and logistics