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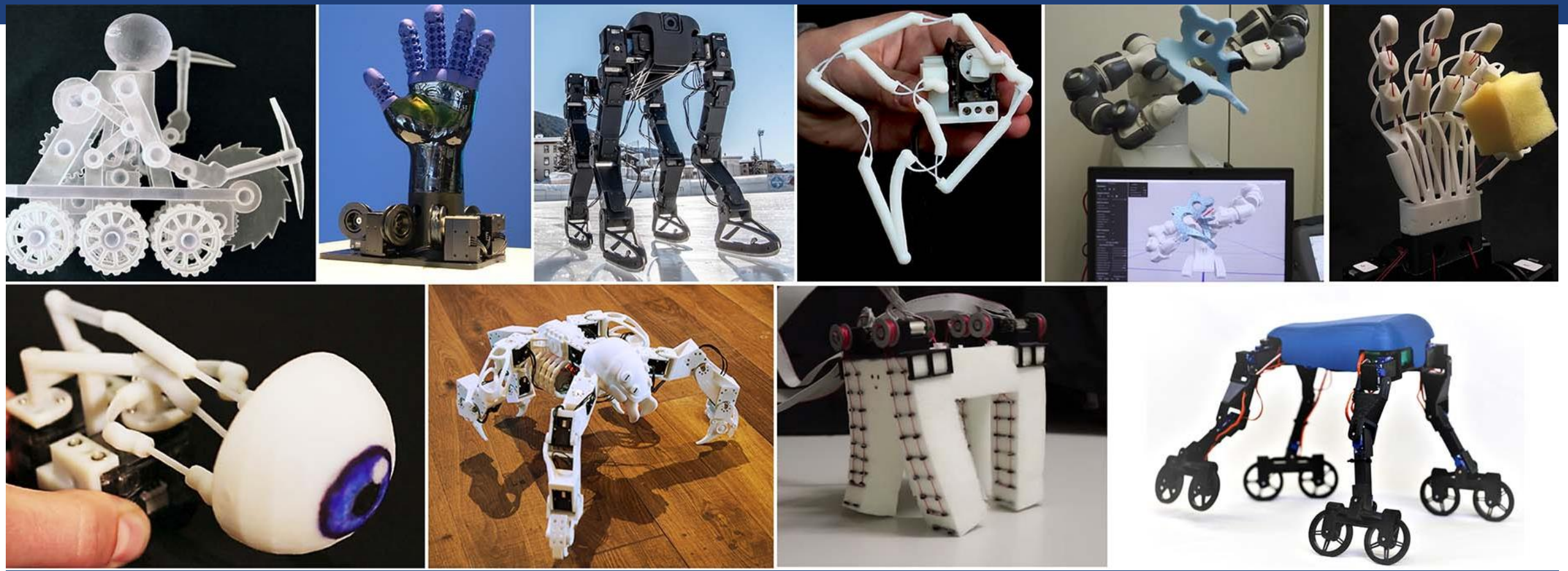

Computational Models of Motion

CRL

Introductions

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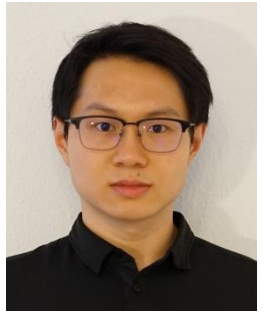

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Computational Models of Motion

Computational Models of Motion for Character Animation and Robotics

Computational Models of Motion for

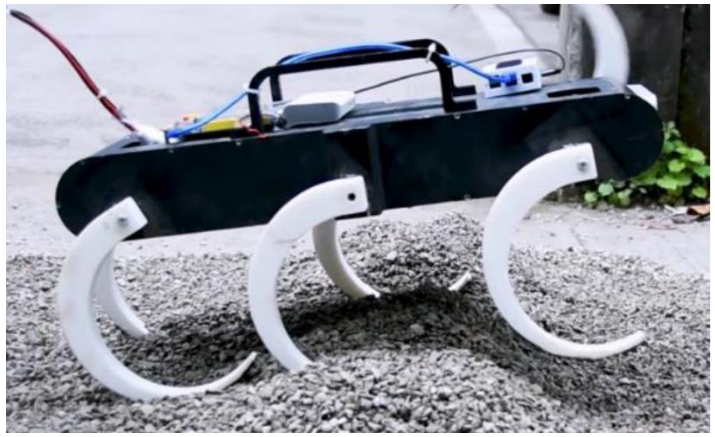
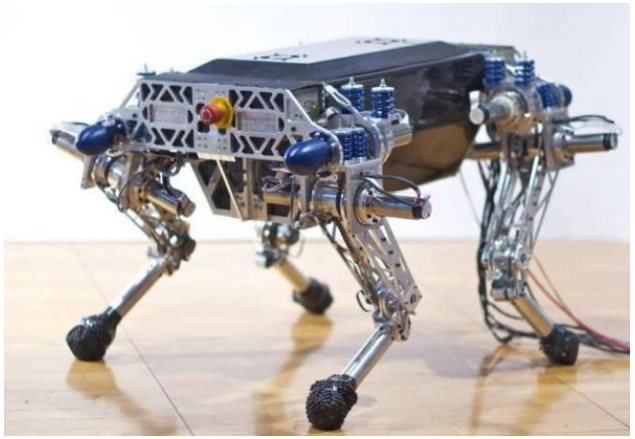
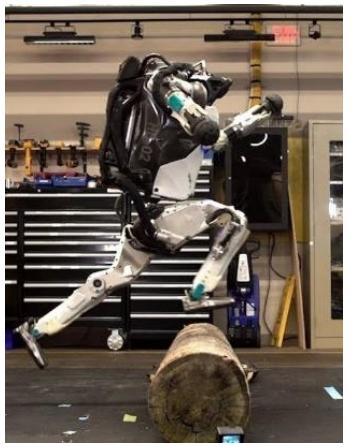
Character Animation and Robotics?

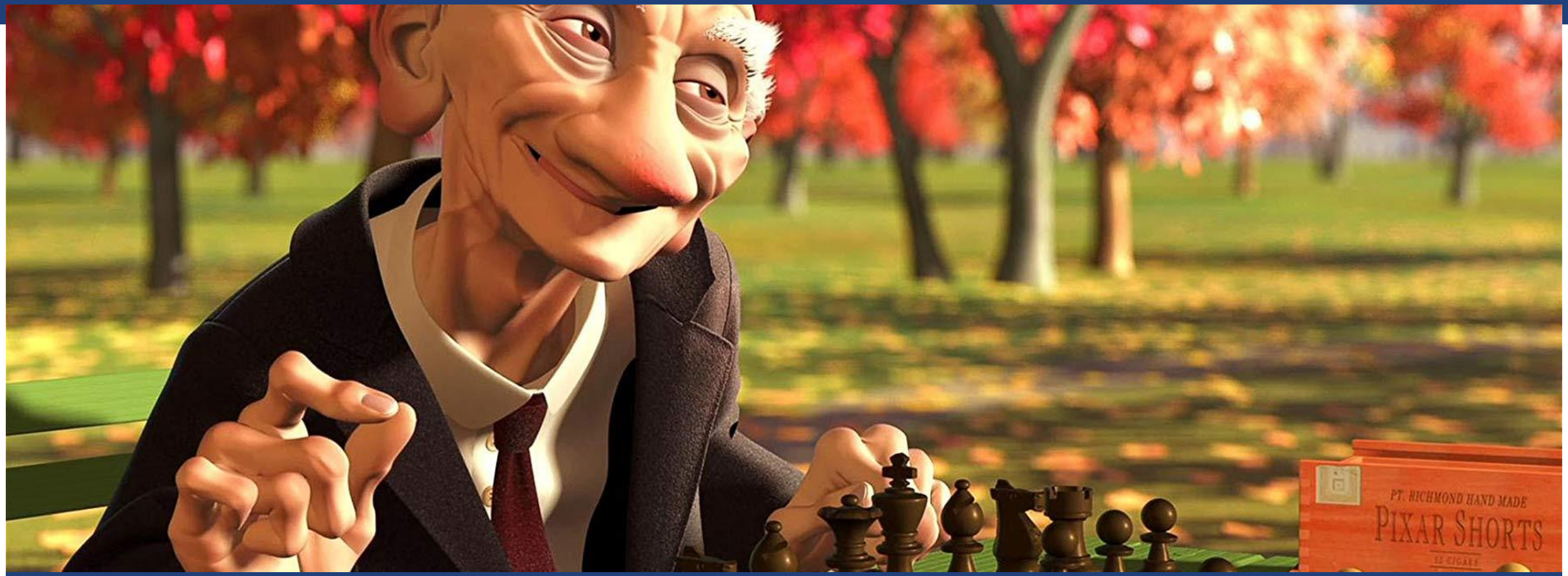
From character animation to robotics









Character Animation

Characters in animated movies

https://www.youtube.com/watch?v=gEkAxjjuUE0

Characters in animated movies

© Disney, Zootopia

Characters in animated movies

Live-action films: motion capture and digital actors

https://www.youtube.com/watch?v=txoEDIdbUrg

Video Games: data-driven character control

https://youtu.be/Ul0Gilv5wvY

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Physics-based Character Animation

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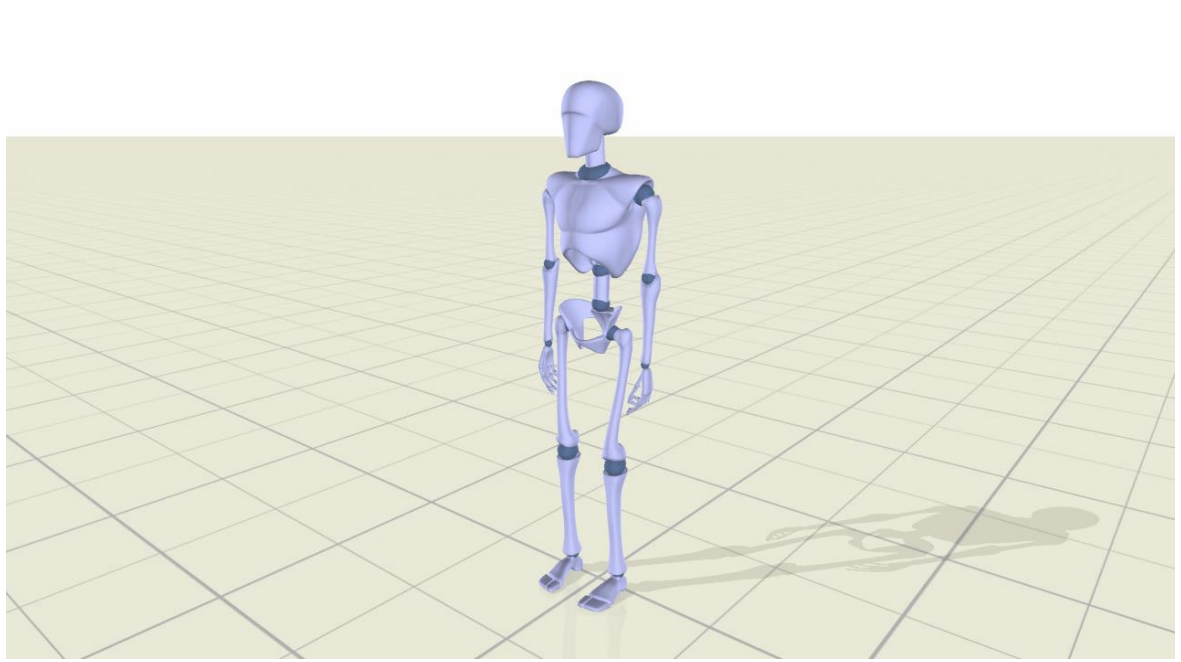
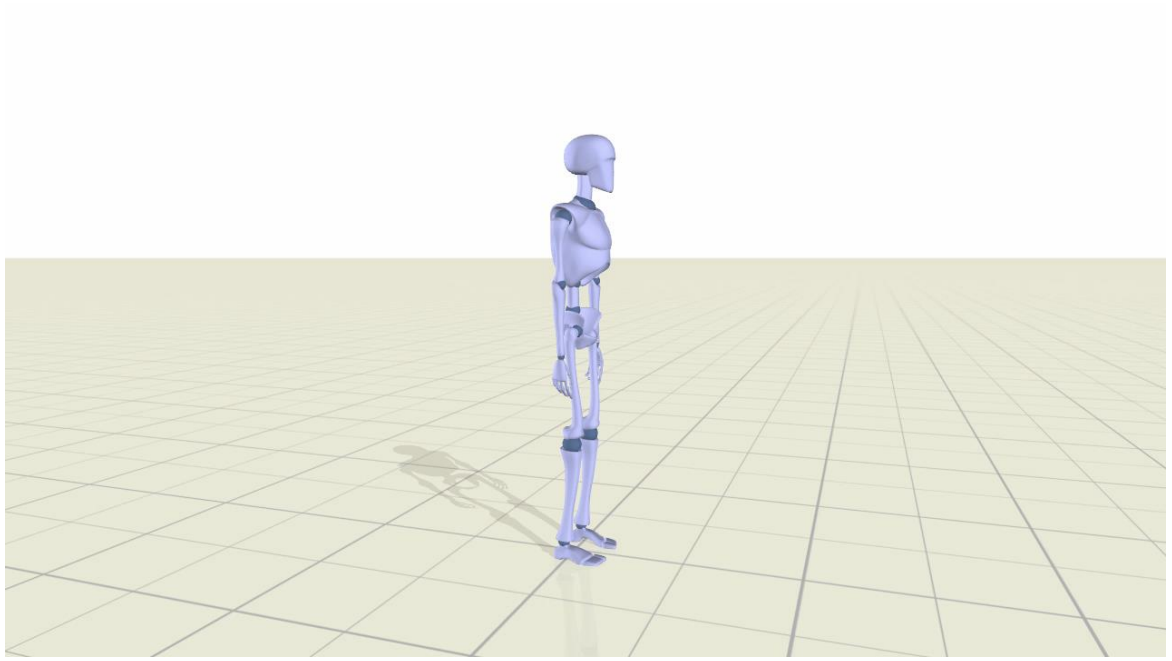
Physics-based characters: motion through motor control

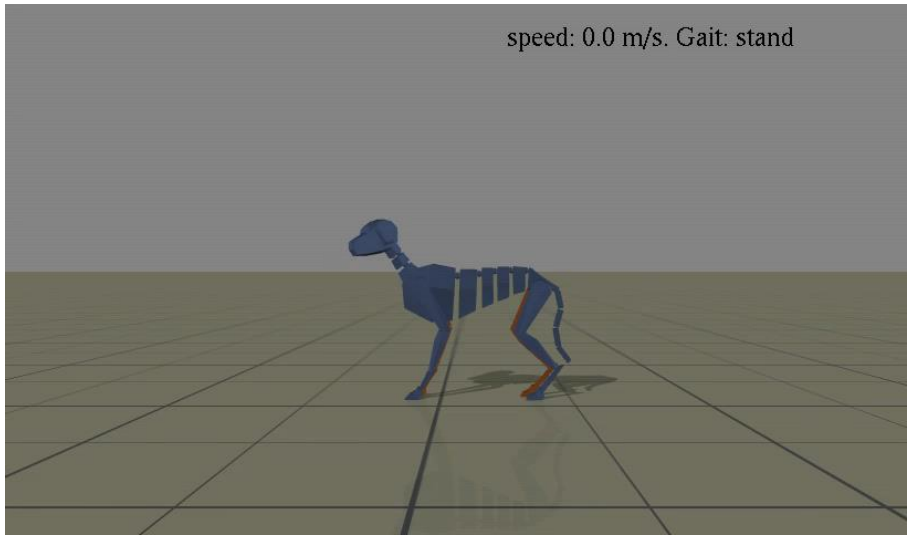
$$F = m\,a$$

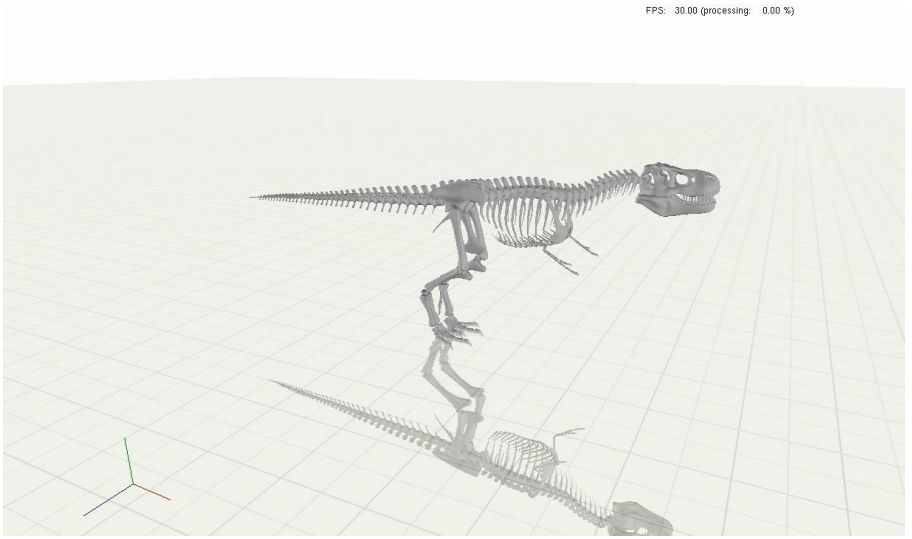
Physics-based characters: motion through motor control

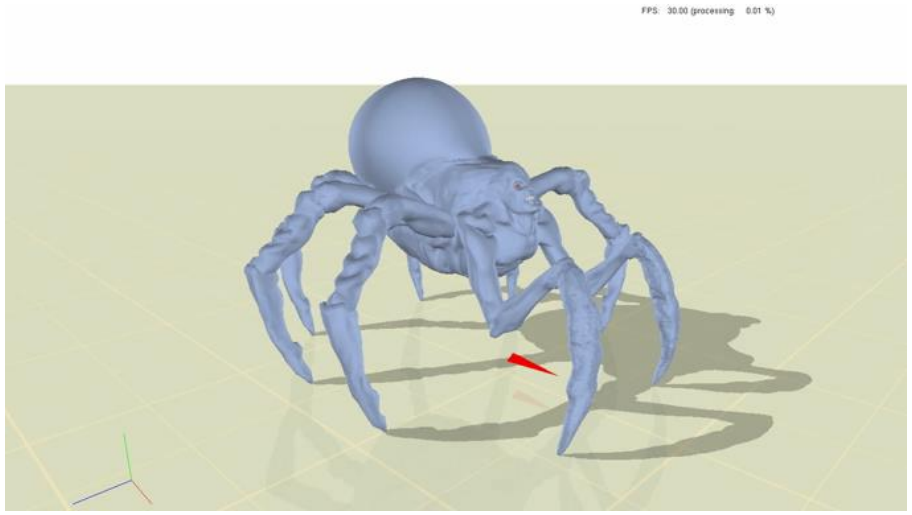


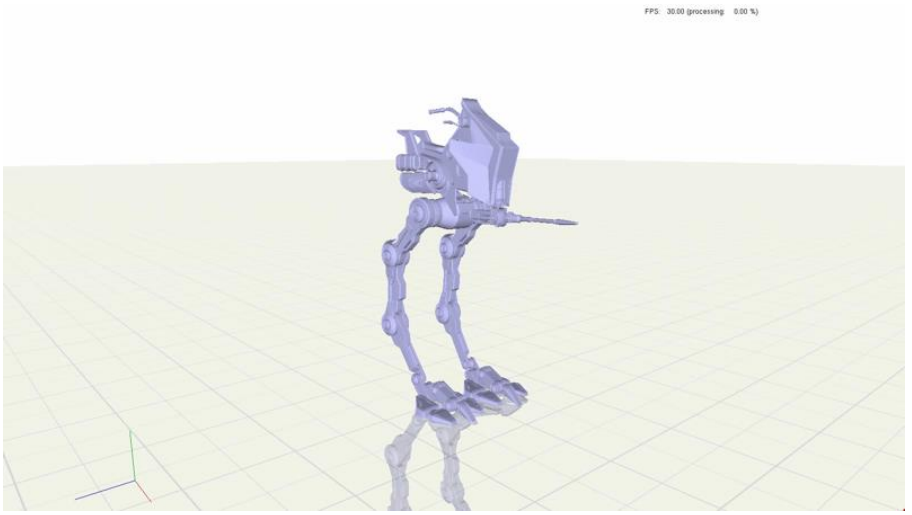


Physics-based characters: morphological zoo

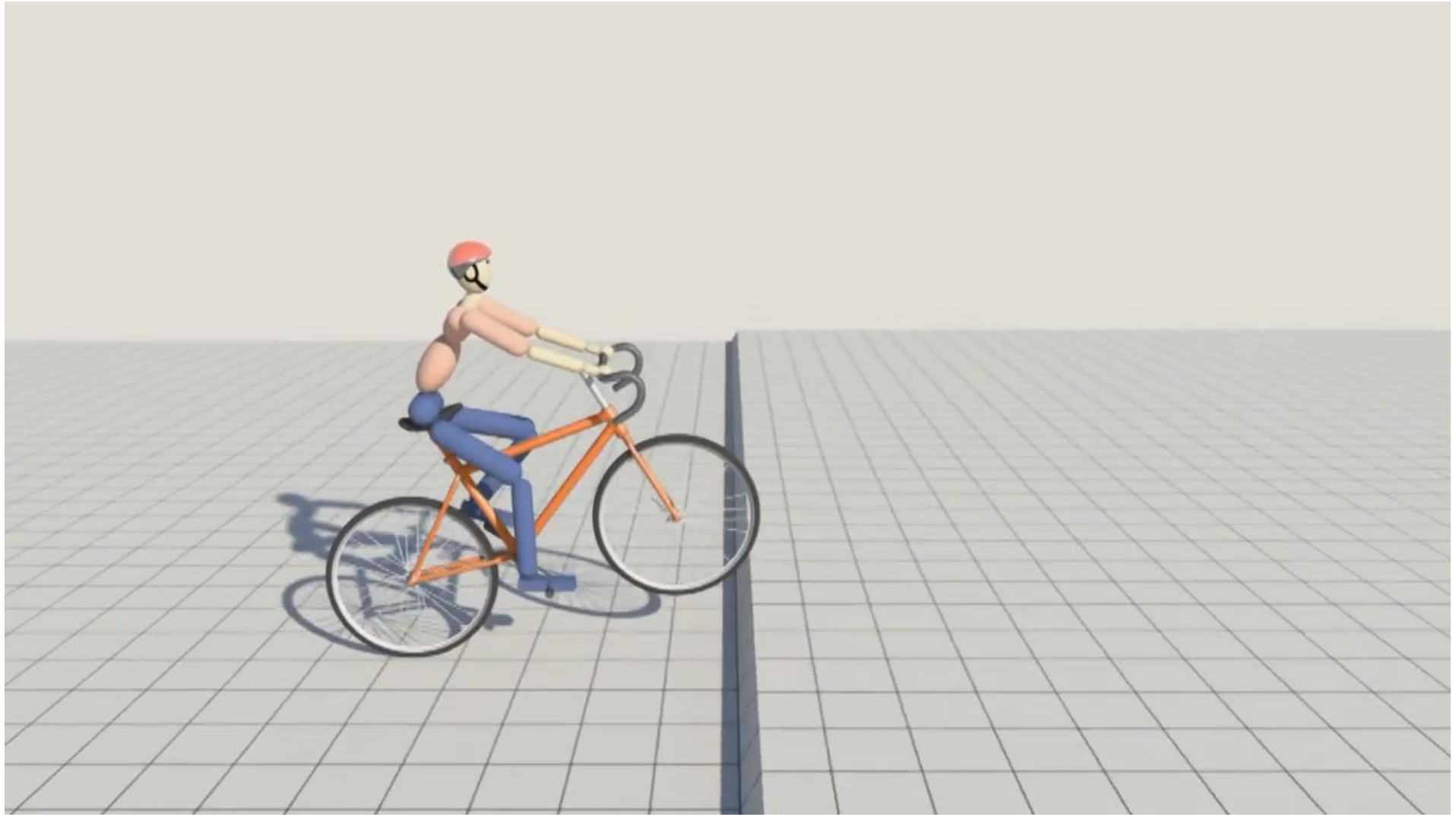








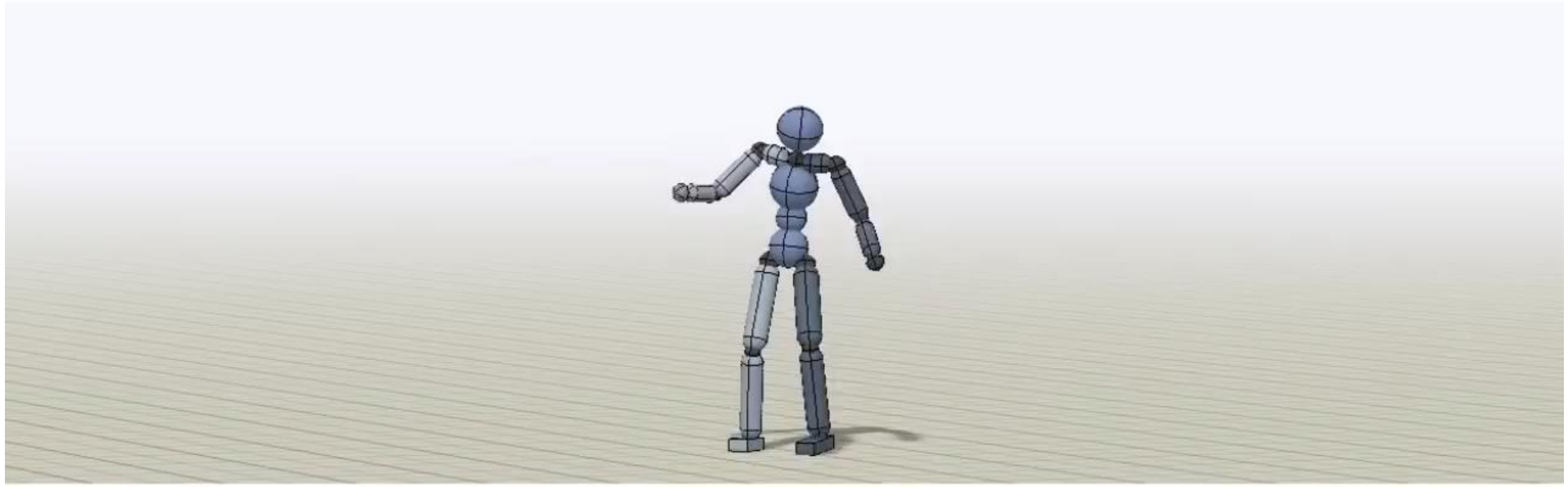
Physics-based characters: advanced locomotion skills



https://www.youtube.com/watch?v=Mh8t_TuI3B4&feature=youtu.be

Physics-based characters: advanced locomotion skills

DeepMimic: Example-Guided Deep Reinforcement Learning of Physics-Based Character Skills



Xue Bin Peng[1], Pieter Abbeel[1], Sergey Levine[1], Michiel van de Panne[2]

[1] University of California Berkeley

[2] University of British Columbia

https://www.youtube.com/watch?v=vppFvq2quQ0

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The Intersection of Character Animation and Robotics

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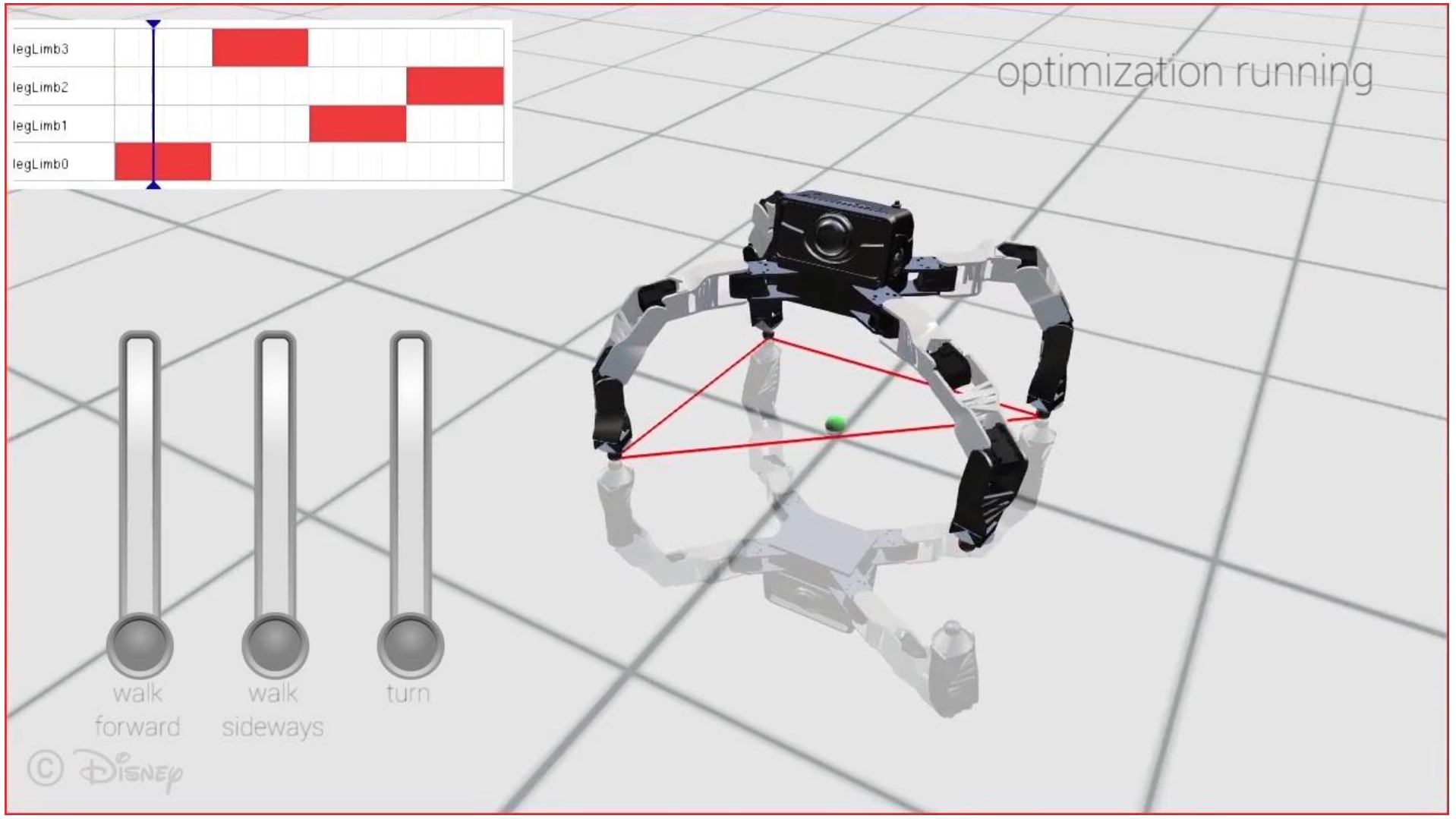
Sim-to-real: from animation to robotics

Robot Designer: animation tools for legged robot design



https://www.youtube.com/watch?v=bmNqMt0kSRw

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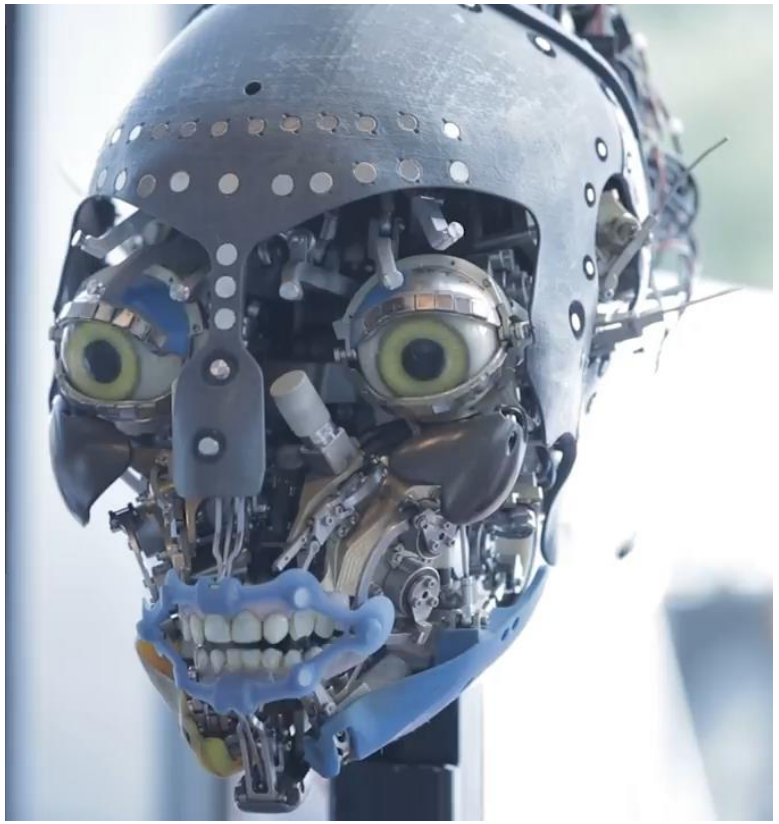
Film-to-real: animatronics at Disney

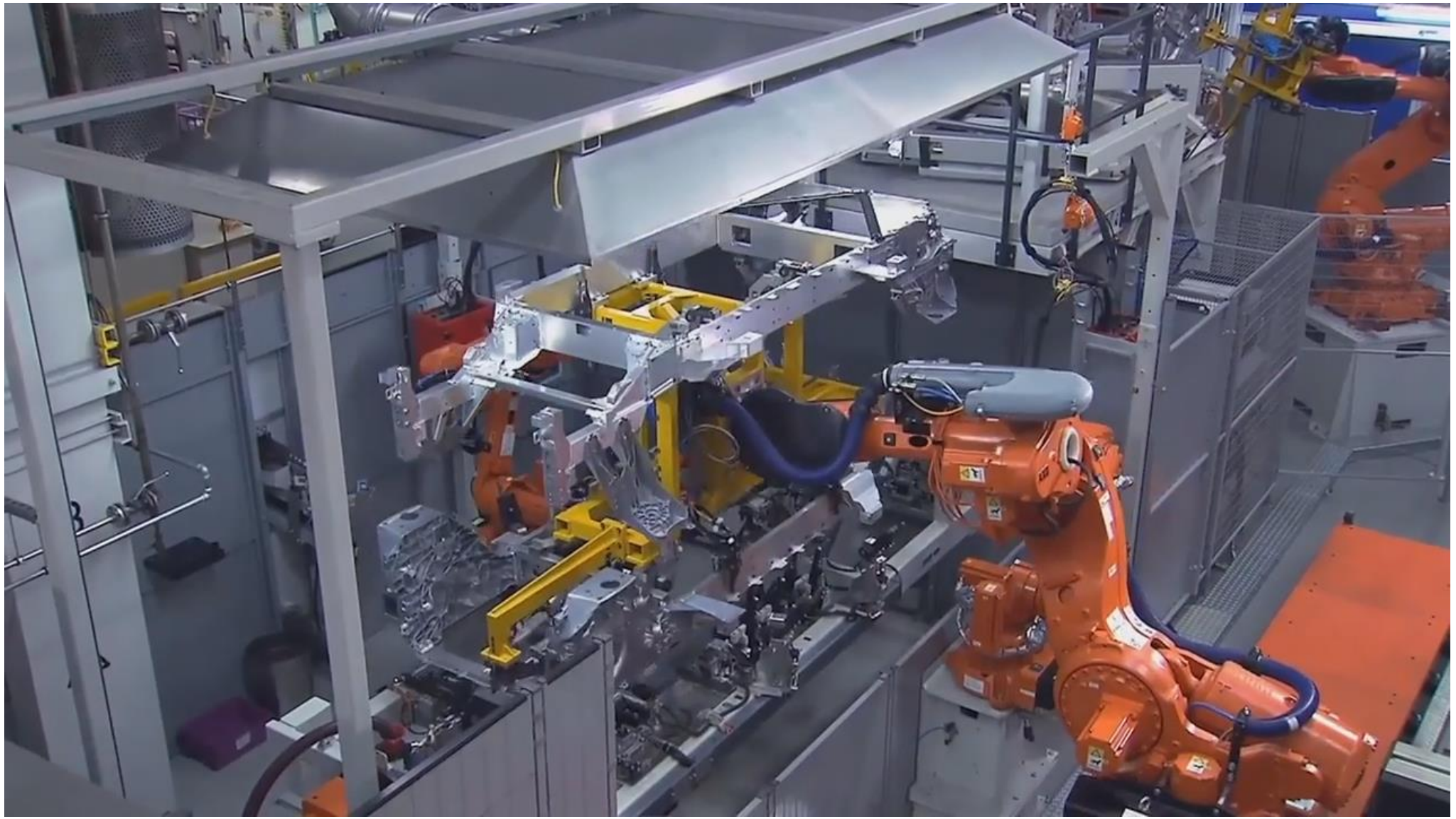
[James Cameron, 20th Century Studio, 2009]



[Walt Disney Imagineering, 2016]

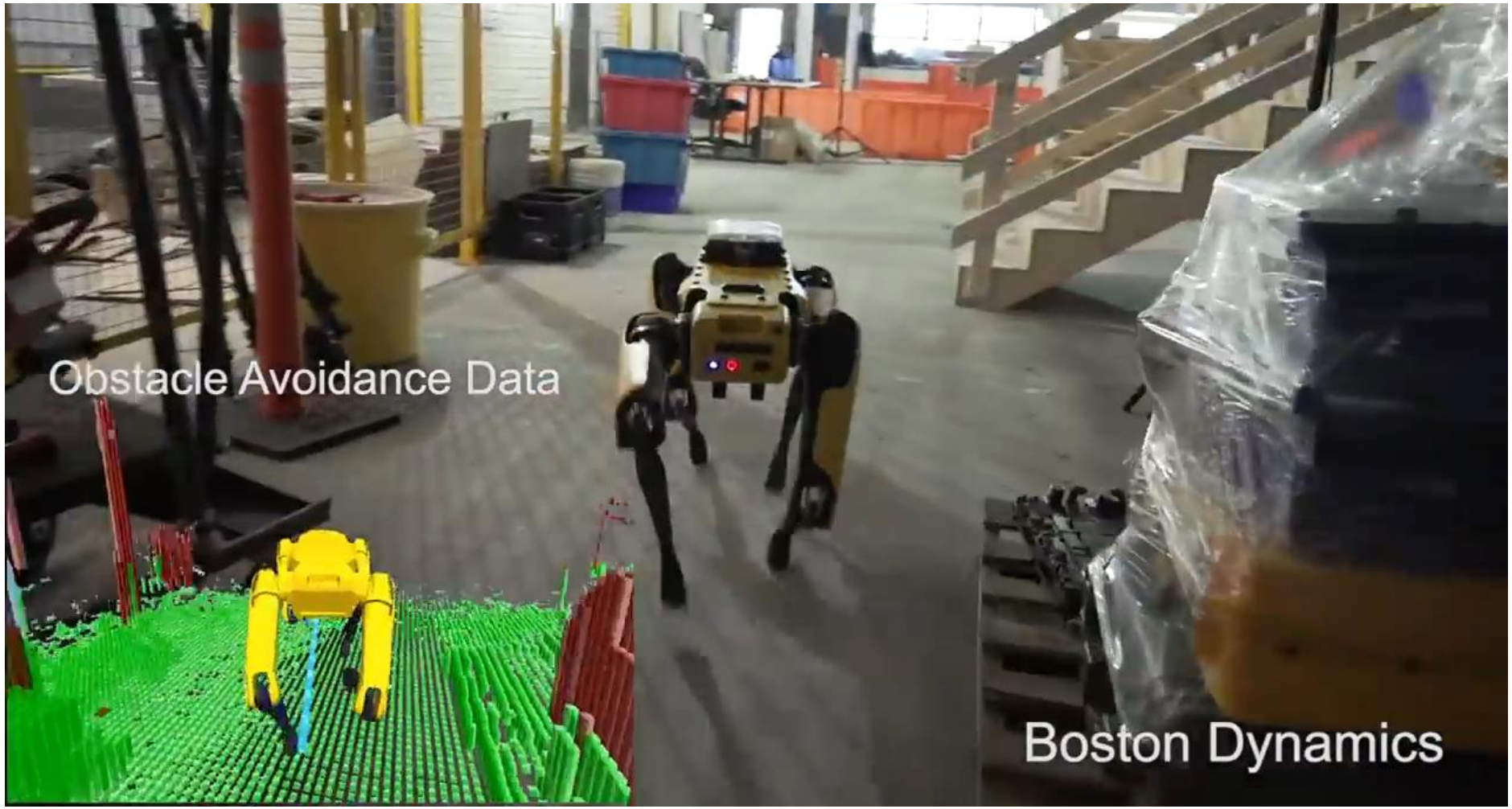
Robotics

Today's robots



Today's robots

Today's robots



https://www.youtube.com/watch?v=Ve9kWX_KXus

Agility on wheels

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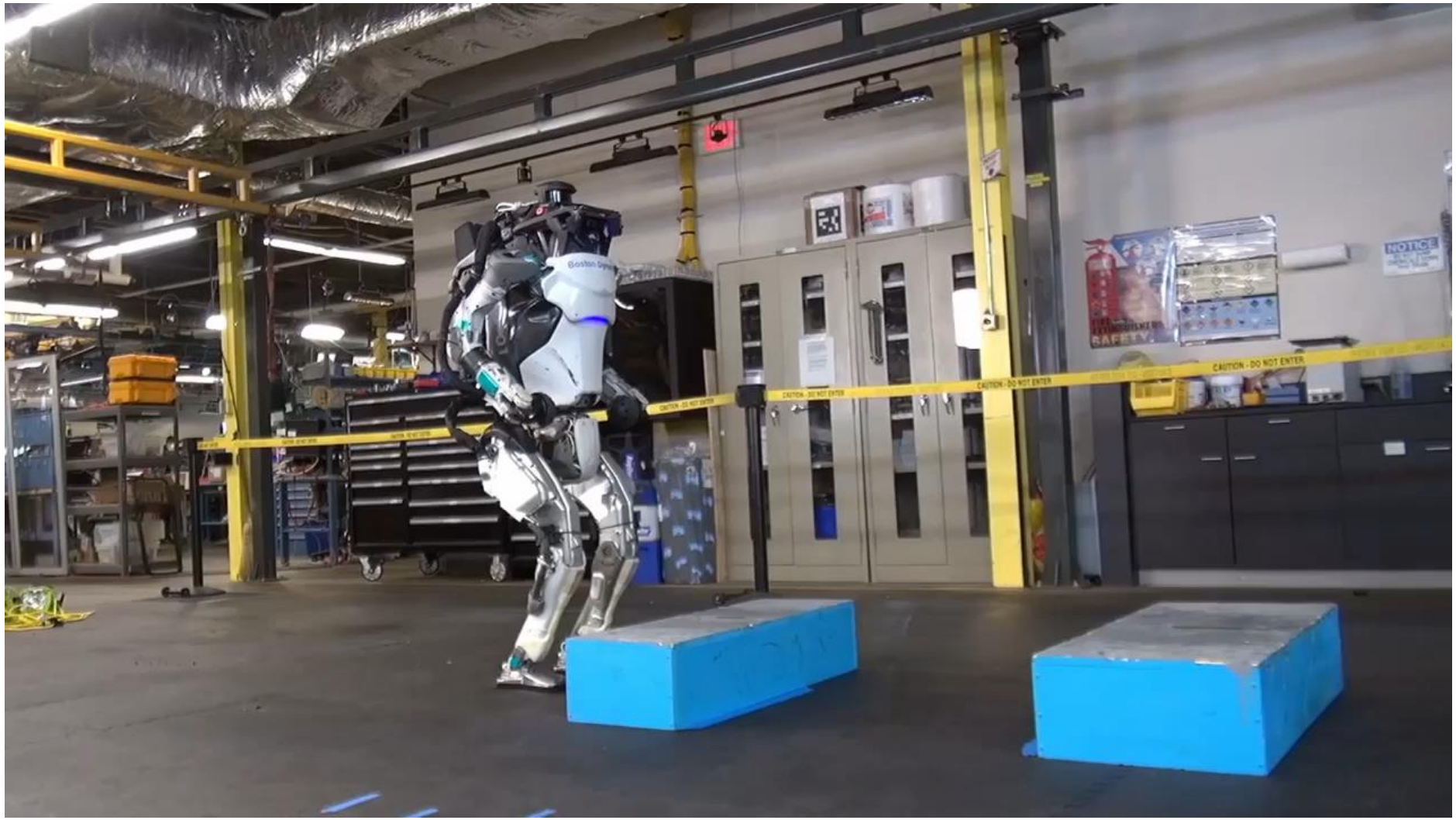
Agility on skates

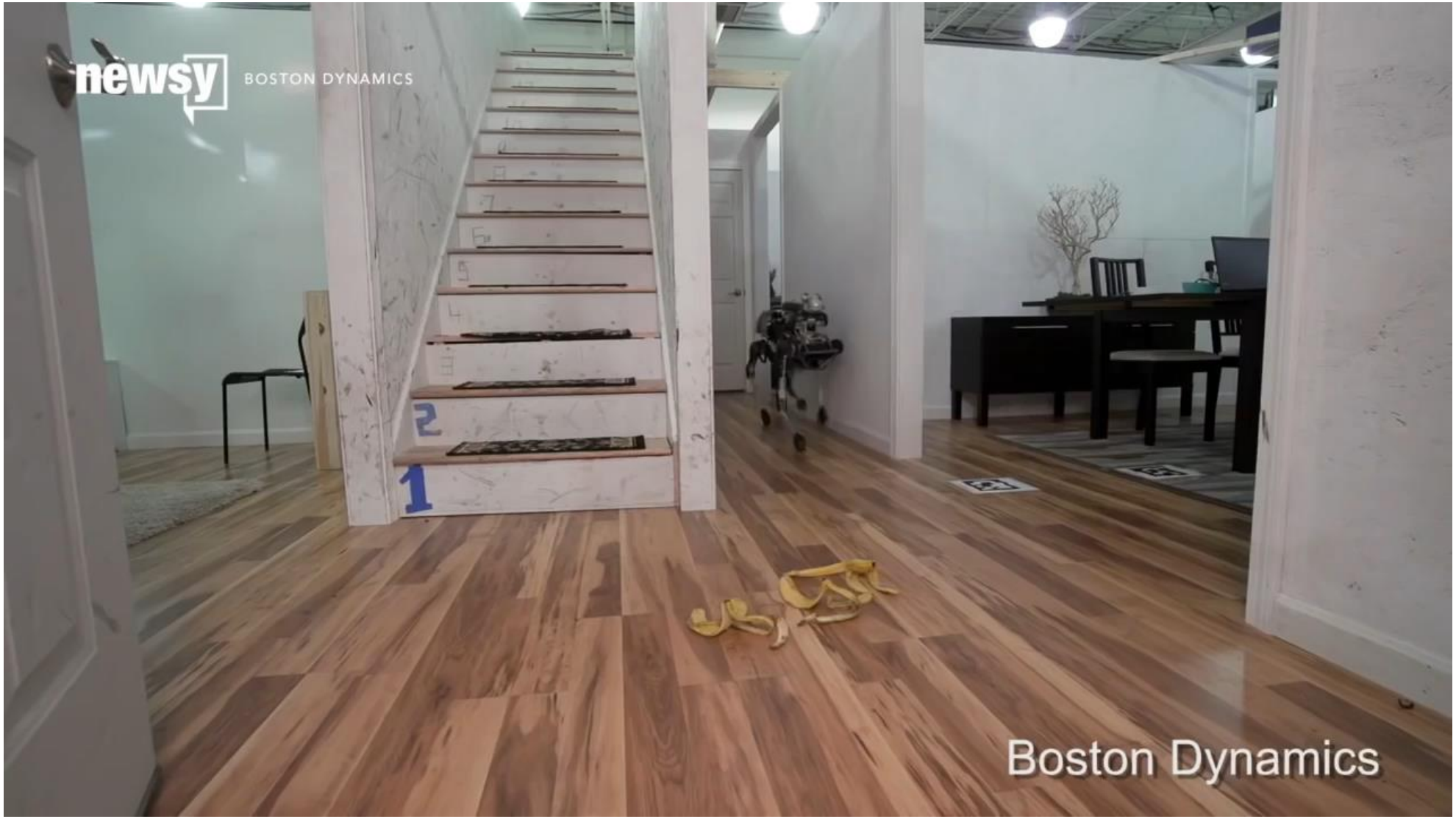
The state of the art



https://youtu.be/fRj34o4hN4I

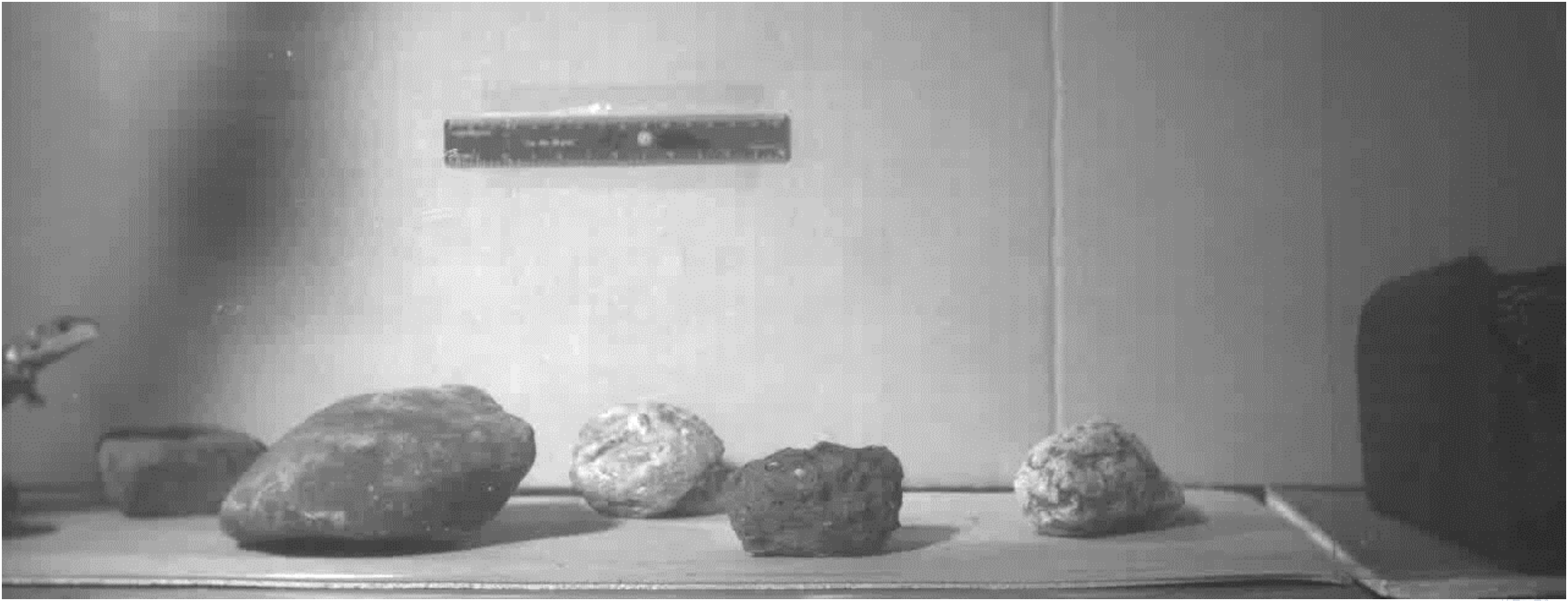
Are we done?

Are we done?



Organic machines designed by Nature

Organic machines designed by Nature



Compliance: safety and performance by design


Alexandre Ferreira / CC-BY-2.0


Barry Goyette / CC-BY-2.0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User: fallingdominos / CC-BY-2.0

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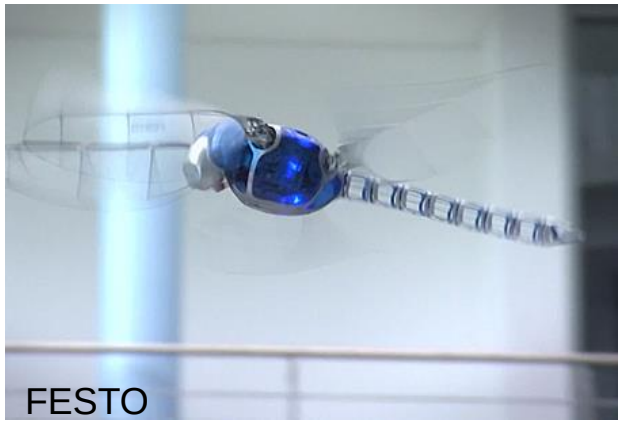
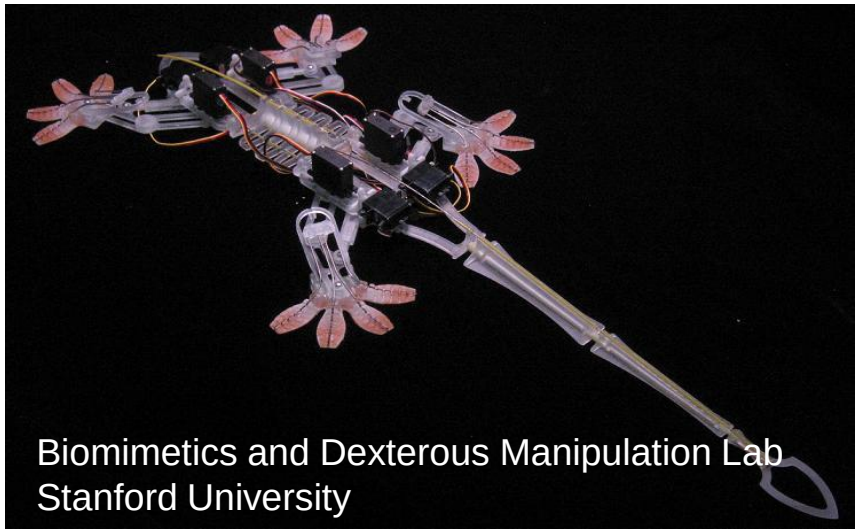
Do robots have to be rigid?

© Disney, Big Hero 6

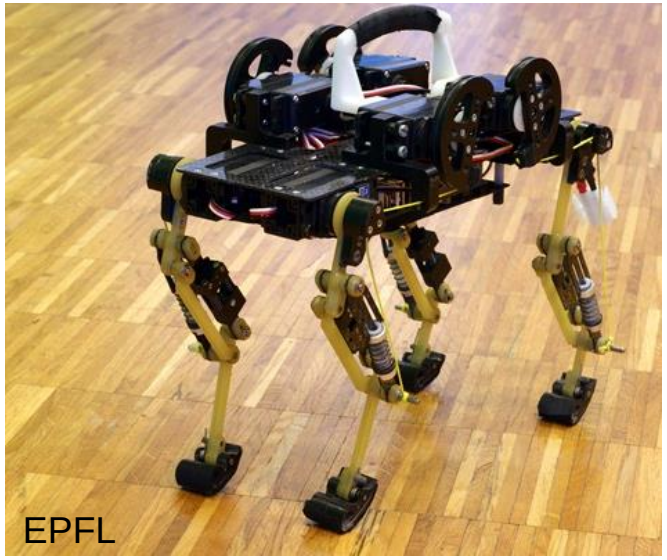
Compliant robots


FESTO


Biomimetics and Dexterous Manipulation Lab
Stanford University


FESTO


Movement Control Laboratory
University of Washington


EPFL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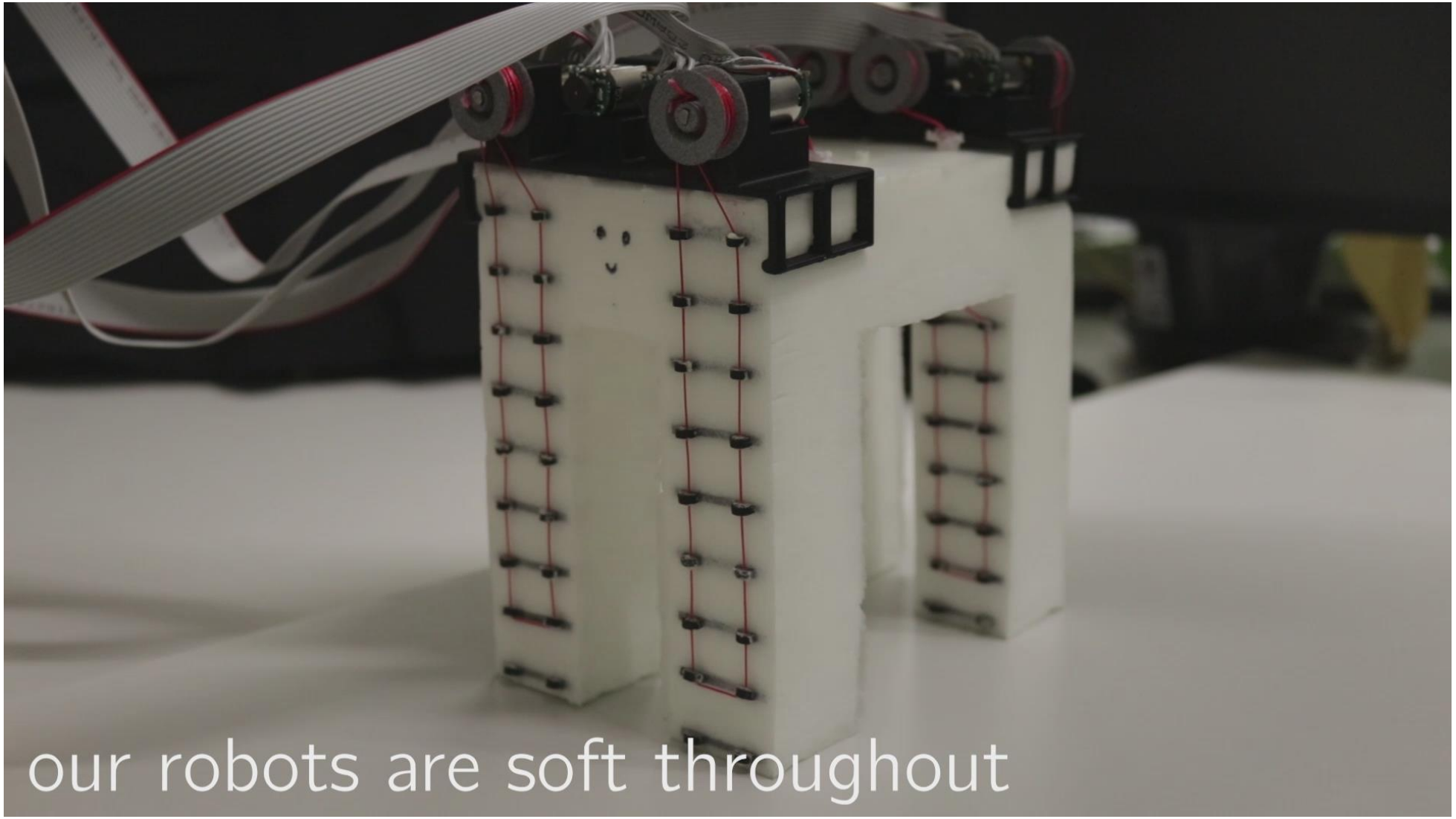
Compliant robots: challenges and opportunities



[CRL, RSS 2019]

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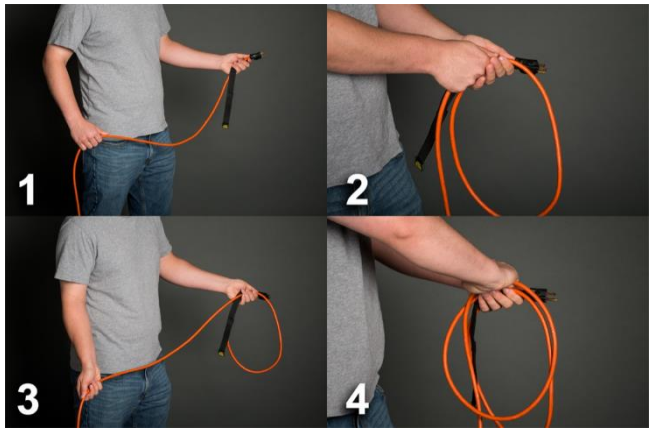
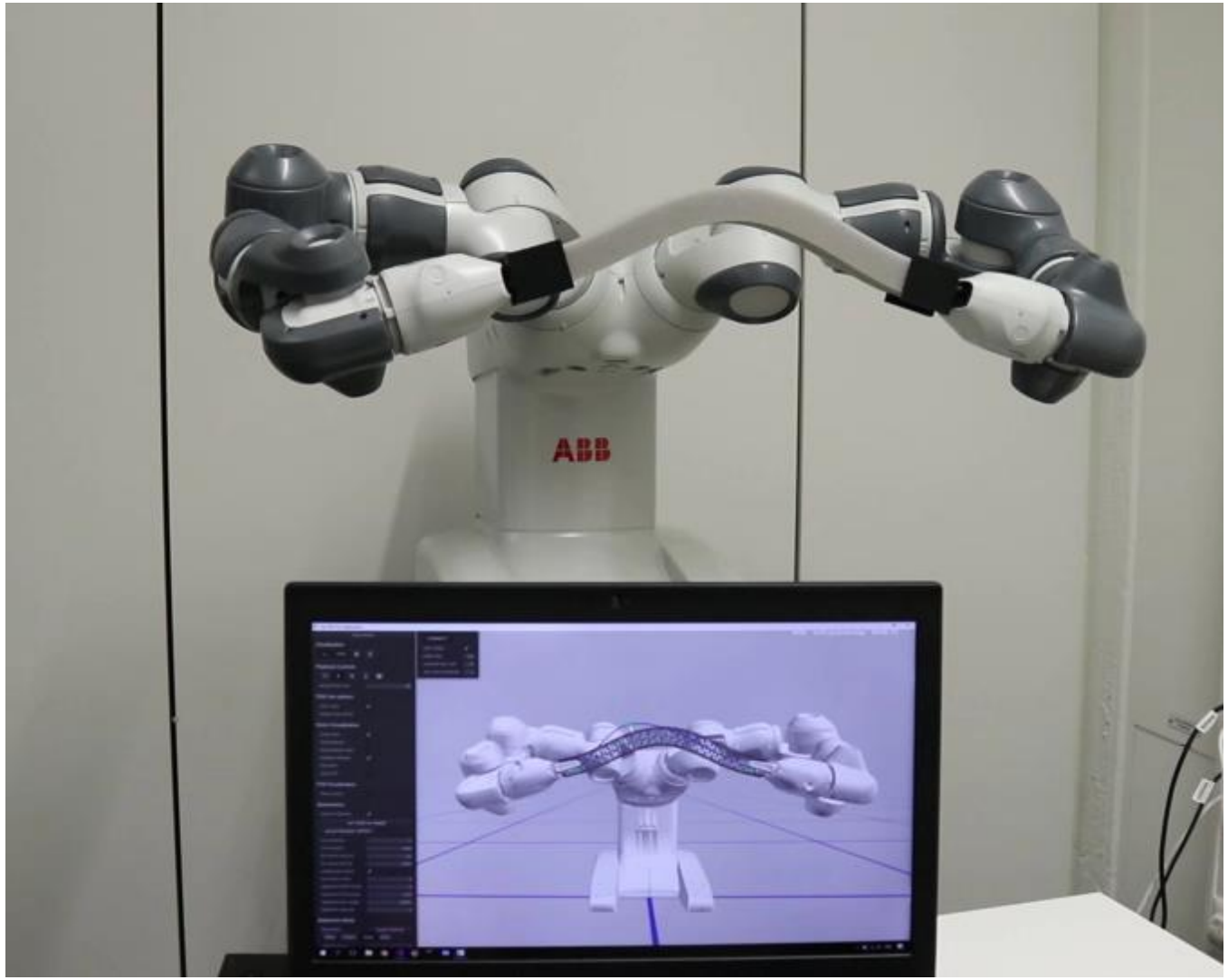
Manipulation & Interaction

Real-world human manipulation



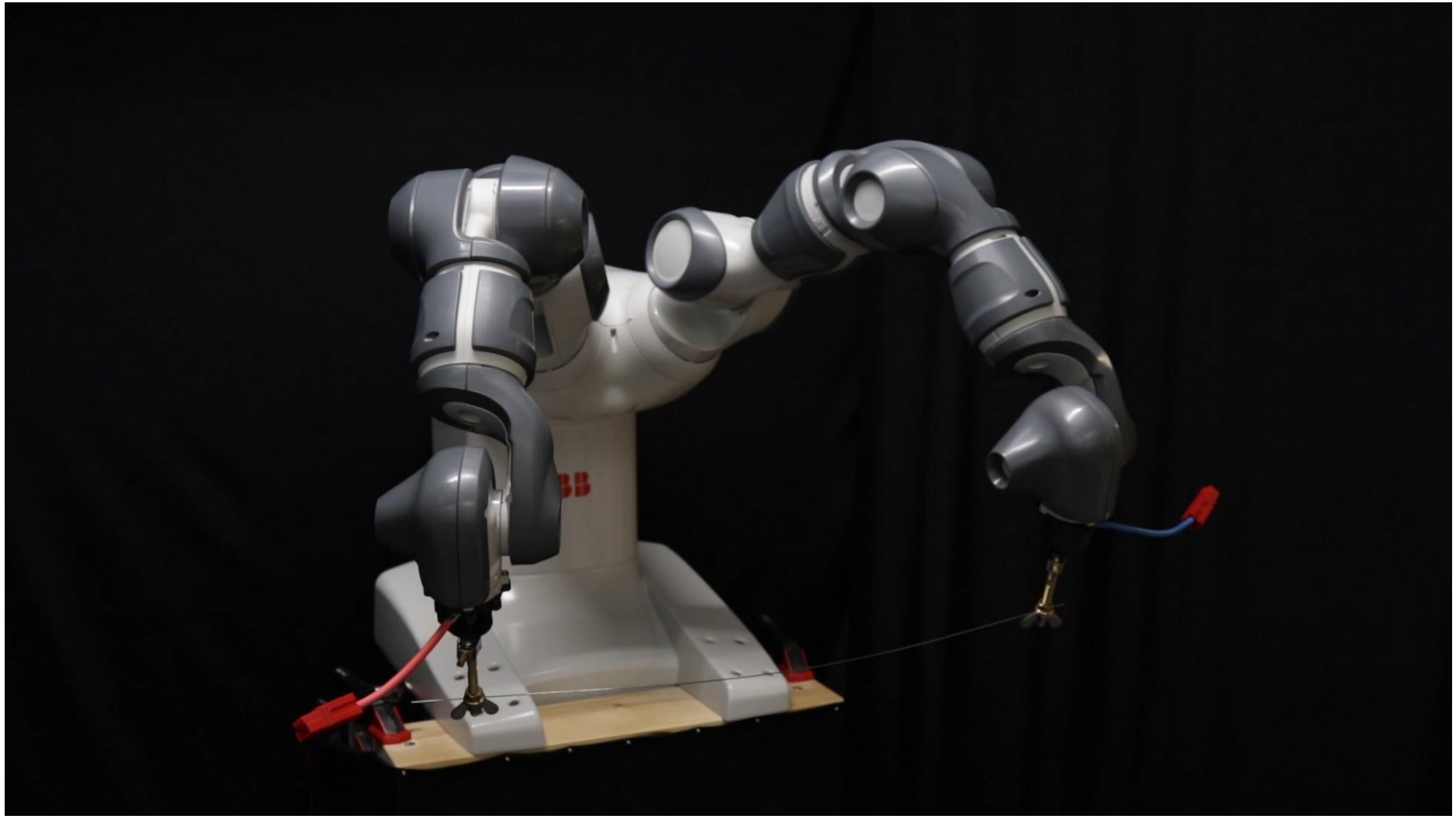
Real-world human manipulation

Robotic manipulation: soft materials

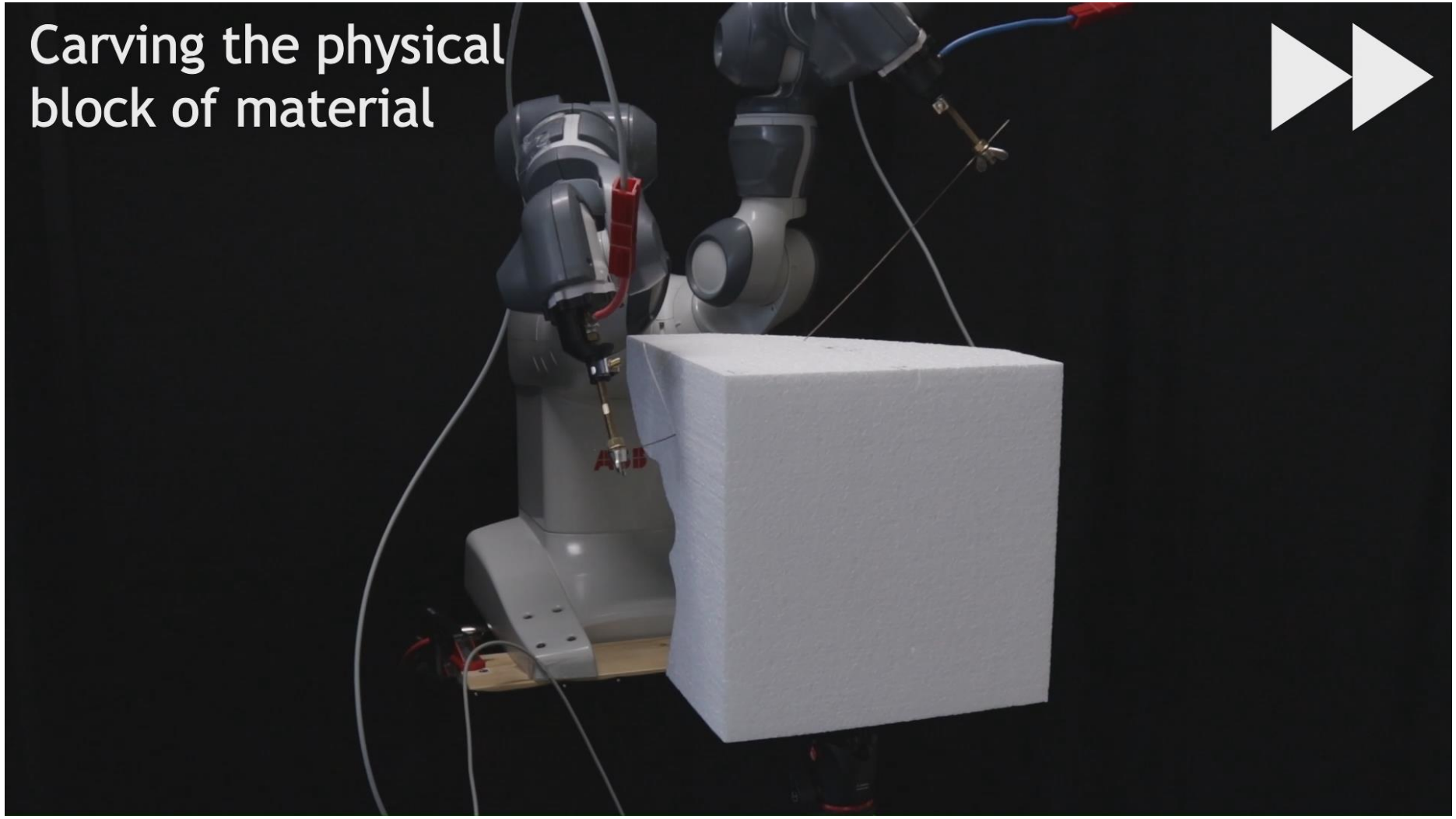


[CRL, IROS ‘18]

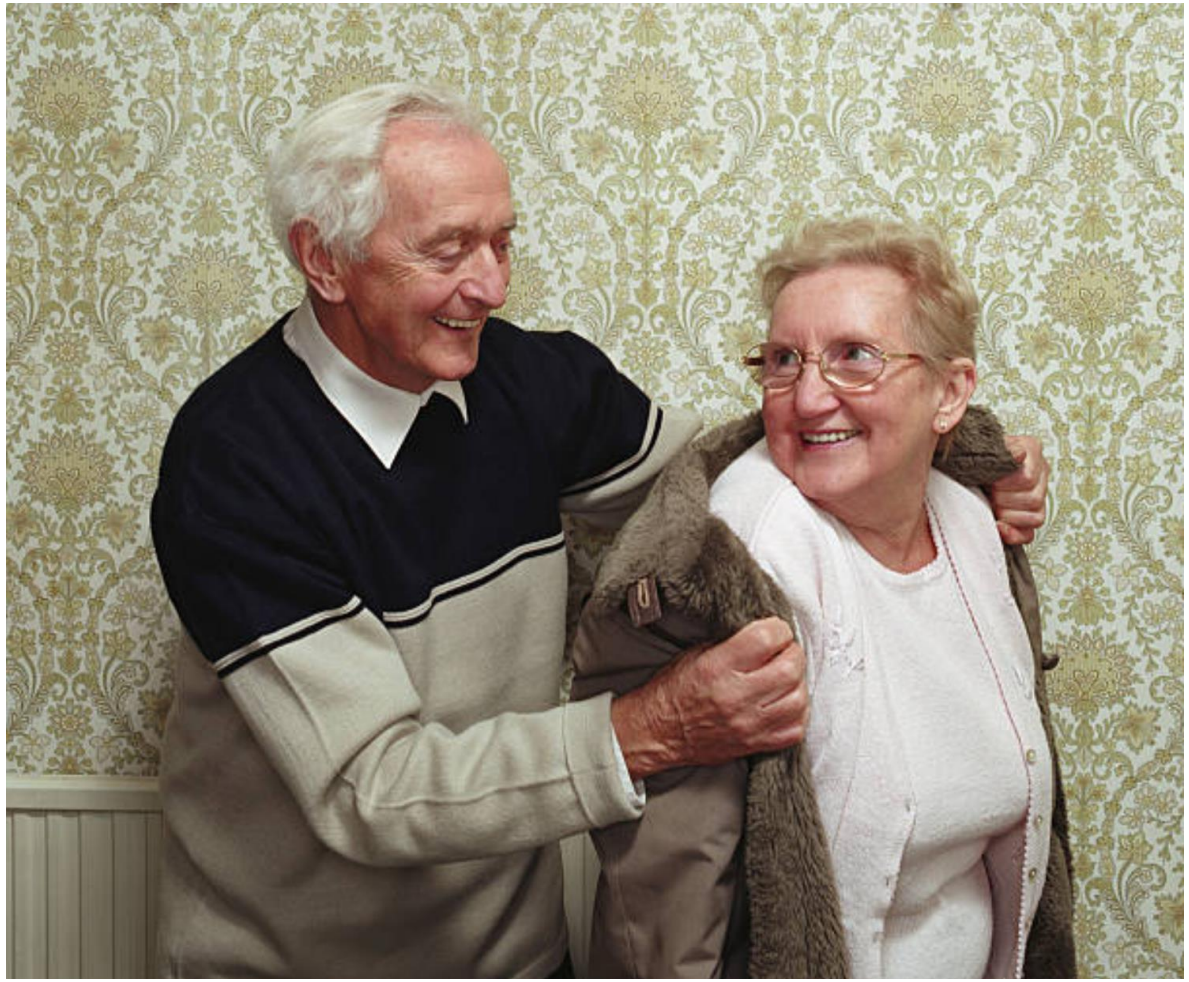
Robotic manipulation: using tools



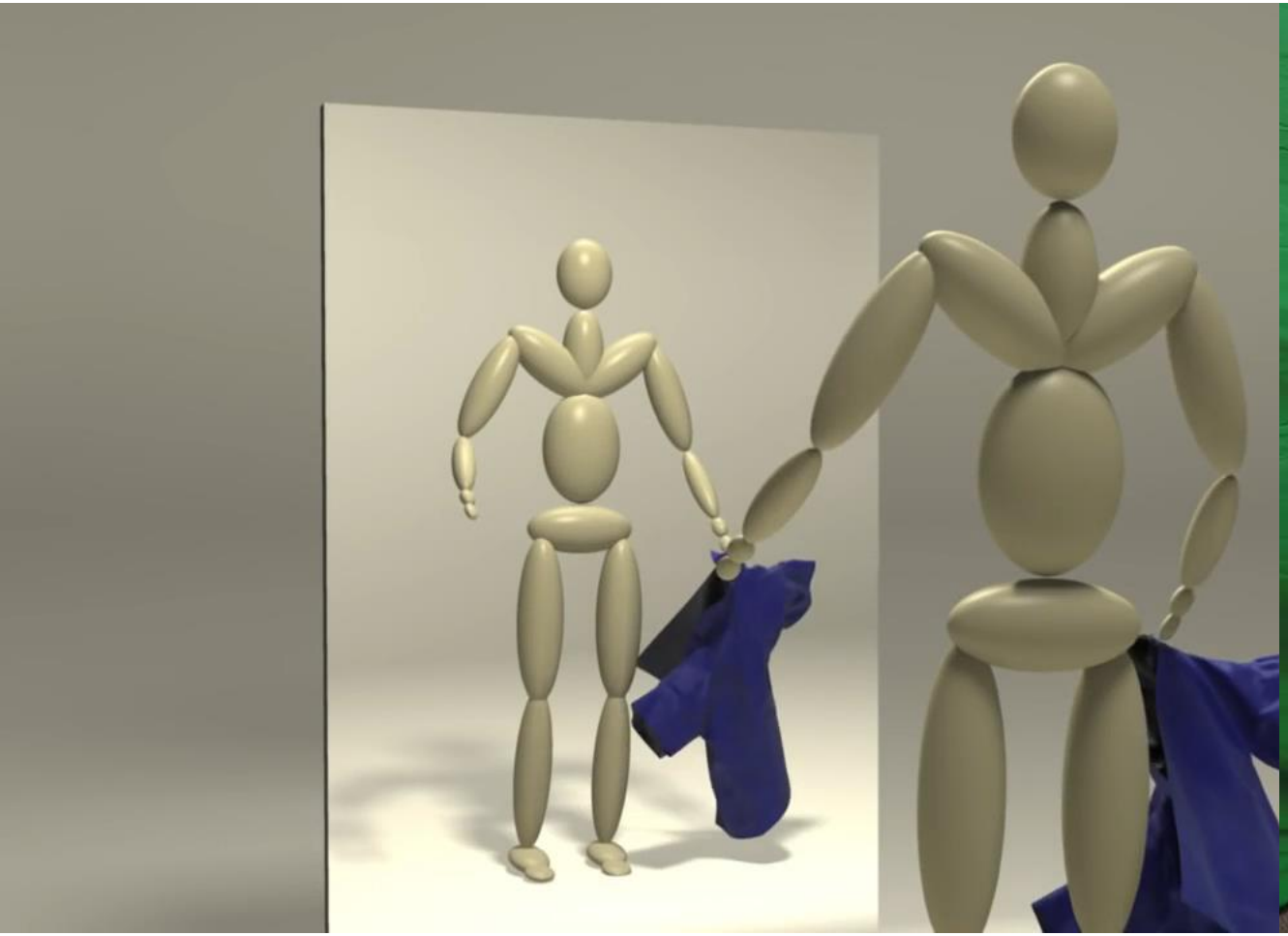
Robotic manipulation: using tools



Robotic Assistance



Robotic Dressing



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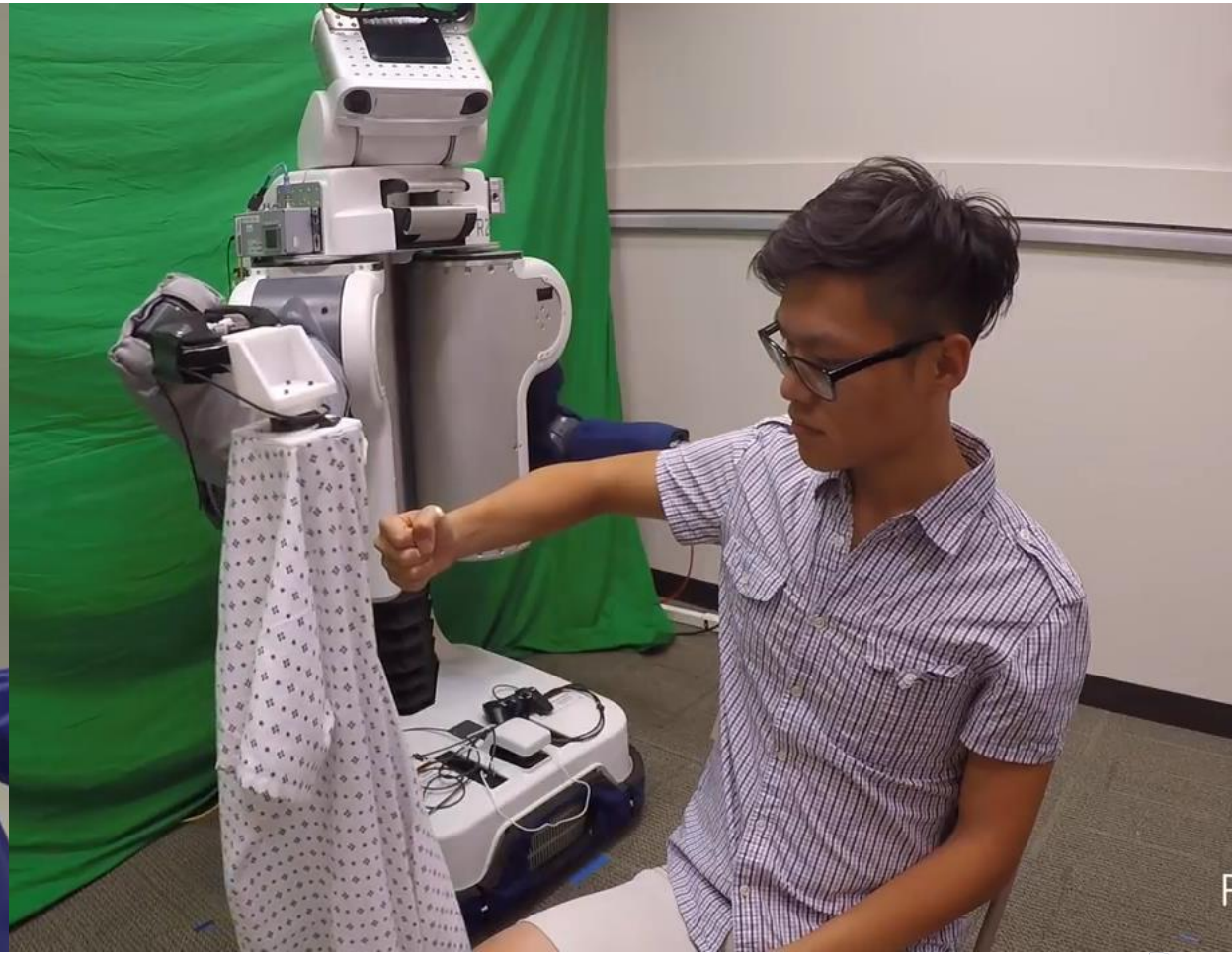

https://www.youtube.com/watch?v=Fb_SexsljLI&feature=youtu.be

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