

# Modeling and Simulation in Robotics Workshop

Breakout Summary Slides

Team 6

Breakout 1

# Slide 1: time to dream

- Slide 1:
  - Agree on huge need for robot simulation

# Slide 2: reality check

- Skepticism: many physical layers (each with its own complexity); no understanding of the abstraction barriers to allow to invoke the right degree of accuracy at the right level. Distinguish between Mead&Conway
- 1974 vs. Mead-Neuromorphic 1984.
- Accuracy required is a function of the robustness of controller.
- Robustness can be tested for in simulation (or it can be designed for with suitable theory).
- Sometimes can design for robustness with right abstractions (e.g. spice); as the abstraction barriers go up (e.g. VLSI) get very, very strong. Distinguish between scientific modeling vs engineering style.
- Bio-spice is an example of how hard this can be
- How to determine sufficiency in models? Question under what circumstances do we need to descend to what level of complexity? Avoid molecular dynamics. Simulation should be driven by goals – more fidelity is not necessarily better (e.g. more parameters make accuracy even harder).
- Accuracy may not be that important. But we don't really know how and what the animals are doing when they interact with the world.
- Robustness with respect to what is important.
- ML viewpoint may be helpful – design approximators having huge numbers of parameters and gather huger amounts of data. Can we use a simulator to save the effort of collecting data? E.g. for use in MPC
- Quote: “simulations are doomed to succeed” (Louis Whitcomb, 1985) - discuss
- There are existence proofs that machines can learn on the fly (e.g. animals).

# Slide 3: concrete steps forward

- A system that observes a system in the real world, build a simulation that's accurate enough for forward simulation, and to do it in real time.
- How to learn from failures of simulations;
- How to real-time choose the degree of physical fidelity + appropriate abstraction barrier.
- Analogy to drug development – how did we get the different animal models of different diseases.?
- A really accurate physical model is never going to be the way ahead:
- Take inspiration from animal brains accumulating experience over millions of years and then converges quickly in experience.
- Proper id for a change!