

# Modeling and Simulation in Robotics Workshop

Breakout Summary Slides

Team 4

Breakout 3

# Slide 1: Consensus Thinking

- 1) Benchmark models associated with real robots
  - Equivalent test bed on a real system, e.g., Robotarium at GA Tech
  - OK for cheap robots are useful but concerns about crashing for expensive ones.
  - Concrete step: Could use mixed reality for expensive robots – some robots virtual, others real, but in simulation all are ‘real’
- 2) Abstraction
  - Challenges from the real world for validation
    - How you set up the sand for your robot to walk on affects your experiment
    - Do we need different modes of how the sand operates, or is a qualitative model enough
    - Rare events, e.g., quicksand vs sand
  - Modeling effects of hardware
    - Done in other domains, not in robotics in general. ROS does it to some extent.
  - Concrete step: Strive for sufficiency, not for perfection, for concrete next step
  - Concrete step: leverage techniques used in other domains such as reduced order modeling

# Slide 1: Consensus Thinking

- 3) Composability
  - Need a platform, or standard architecture
    - High fidelity is domain specific, how do we make it interoperable, composable, etc.
    - Framework should be able to connect varying-fidelity simulation
  - Demand-driven modeling and simulation
    - “distributed Gazebo example”, a head-simulator puts individual simulations together
    - “agent-based zones in a building example” first principles models plus data-driven models
  - Concrete step: make these more general

## Slide 2: “Somewhat contentious” Ideas

- Standards for describing robot models
  - Pro: For the cases that we know what elements need to be in the model
    - Dynamics, contacts, sensors, actuators,
  - Con: For certain cases we do not know how to model

## Slide 3: Odds and ends, out there thoughts, fun stuff

- Simulation is a stepping stone to data driven approaches

# Cheat Sheet Slide

- Breakout Themes, “M&S in Robotics” workshop:
  - Breakout 1: Panoramic view of opportunities  
[a time to dream]
  - Breakout 2: What’s stopping us from getting there  
[the reality check]
  - Breakout 3: Pragmatic suggestions for moving forward  
[what funding organizations, the robotics community,  
or other vested parties can/should do]

- Breakout session, things to keep in mind
  - You have 25 mins to generate your three slides
  - Select a scribe to generate your three slides
  - Decide who will present your slides in plenary
  - Do not argue within team for more than 2 mins about an idea. Move it to “Slide 2” and proceed
  - Generate diverse/original/out-there ideas
- Plenary session, things to keep in mind
  - Each team has 5 mins to present its slides
  - We seek to collect as many original ideas/points of view/opinions as possible
    - Settling contentious issues not a priority
  - Use open-floor discussion to add to what the teams have presented
  - Limit your remarks to one to two minutes. Give others an opportunity to speak. Keep it fun, keep it friendly