COMANOID
Locomotion Workshop
Goals and Metrics

Pierre-Brice Wieber
INRIA

M36 Deliverables

- D1.1 Report on multi contact planning and control (DLR)
- **D1.2 Report on walking (INRIA)**
- D2.2 Methods and software on visual perception and contact sensing for demonstration on TORO and HRP-4 (INRIA)
- D3.2 Safety falling procedures and strategies (INRIA)
  (2 yr post-doc position available on fall avoidance)
- D4.2 Integrated humanoid robot software and mission specification (AIRBUS)

2016 Review Report

- The consortium is requested to submit due deliverables D3.4, D6.1 and D6.2 intended to report about ethic management as soon as possible.

- **Software integration must be better planned.**

- More attention must be paid to scalability of the system for different aircrafts and scenarios.

- The consortium should investigate the introduction or use of other sensors perception and localization, besides vision already used.

- **The future demos in real environment need to be normalized in order to allow calculating comparable benchmarks.**

Goals

- Report on walking
- The future demos in real environment need to be normalized in order to allow calculating comparable benchmarks.
- Software integration must be better planned.

Model Predictive Control for biped walking

- The dynamics of legged robots
- The dynamics of walking on a flat ground
- The dynamics of falling
- Viability and capturability
- Model Predictive Control
- Dynamics of the whole body, and artificial synergy synthesis
- Generating walking motions on flat ground with predefined footprints and a capturability constraint
- Generating walking motions on flat ground with predefined footprints and no capturability constraint
- Generating walking motions on flat ground with adaptive footprints
- Beyond walking on a flat ground
- Open questions and challenges
- + Motion and force tracking

D1.2 Report on walking

- Can be considered as done.
- I propose we add sections on progress in Comanoid for each partner.
- Maintain unified view and notations.
- Different focuses and design choices: pros, cons, unclear.
- Use cases and results.

Design choices

- Dynamical model
- Terminal constraint
- Constraints
- Assumptions (limitations)
- Safety in behaviour
- Safety in computations

Use Cases & Metrics

- What situations should we consider, for collision avoidance (speed, density, priorities), uneven ground (frequency, amplitude, steadiness), stairs?

- What should we compare: speed, energy consumption, computation time, genericity (possible future developments), robustness, safety?

- We should make precisely defined choices.

Task 1.4: Robust walking

- Locomotion with feet on the ground and no other physical contact with the environment, on a flat or moderately sloped ground, and up and down stairs.

- Physical uncertainties concerning the ground where the robot is walking (e.g., bumps, nuts, screws, cables which may lie on the ground)

- Reach the desired destination even when small modifications of the environment appear (e.g., small temporary obstacles, humans moving around).

Tomorrow’s presentations

- Adaptive step duration in biped walking: a robust approach to nonlinear constraints
- Strong Recursive Feasibility in Model Predictive Control of Biped Walking
- Model Predictive Control of Biped Walking with Bounded Uncertainties
- Collision avoidance based on separating planes for feet trajectory generation
- Humoto software for walking motion generation