

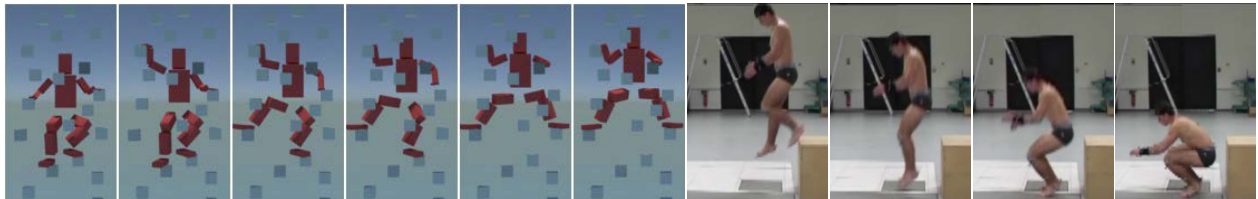
Laboratory: LAAS-CNRS (Gepetto), Toulouse, France

Thematic: Motion generation, robotics, drone

Keywords: Motion generation, humanoid robotics, computer animation, video game

Contact : S. Tonneau, N. Mansard **e-mail:** nmansard@laas.fr, stonneau@laas.fr

Title: Planning contact sequences with aggressive dynamics



We are interested in the generation of complex locomotion patterns with legged systems, typically humanoid creatures using both hands and feet to support their movements. Our mid-term objectives are to obtain behaviors of humanoid robots in structured environments comparable or superior to human capabilities. The overall question of gait locomotion can be separated in several problems: planning contact sequences, generating the whole body movements, controlling the execution, reducing the cost of the numerical resolutions, learning the typical gesture to recover balance, etc.

In this project, we are interested by the top of this stack of problems: generating the contact sequences that would guarantee feasibility and dynamic balance. In [1] we have proposed an original approach, based on heuristics observed during human studies, that enables the planner to find static contact poses with good guarantees to then generate a feasible complete movement. We propose here to extend the approach to enable the generation of dynamics movements, such as jump, running pattern, or smooth walk.

The project is not dedicated to robotics but to the generation and the characterization of any legged system, in robotics, computer animation, and biomechanics. The candidate would work at the border of these three fields and propose a new methodology to the long-studied never-solved problem of complex dynamics locomotion.

Reference:

[1] S. Tonneau, N. Mansard, C. Park, D. Manocha, F. Multon, J. Pettre , “A *Reachability-based planner for sequences of acyclic contacts in cluttered environments* ”, International Symposium on Robotics Research (<https://www.youtube.com/watch?v=LmLAHgGQJGA>)

Requirements:

- A strong mathematical or control background is desirable
- Good programming skills in C/C++
- If possible, any knowledge or practical interest in robotics or computer animation would be relevant

Environment:

Located in the University town of Toulouse, in the south-west of France, the Gepetto group belongs to the CNRS-LAAS, laboratory for the analysis and architecture of systems, a 640 man-strong research center with about 90 people working in robotics. Among our robot fleet, we have access to HRP-2, the only full-size walking humanoid robot in France, while two other humanoid robots are expected within the year. The laboratory benefits from strong connections to the adjoining universities and the space and aeronautics industry.