

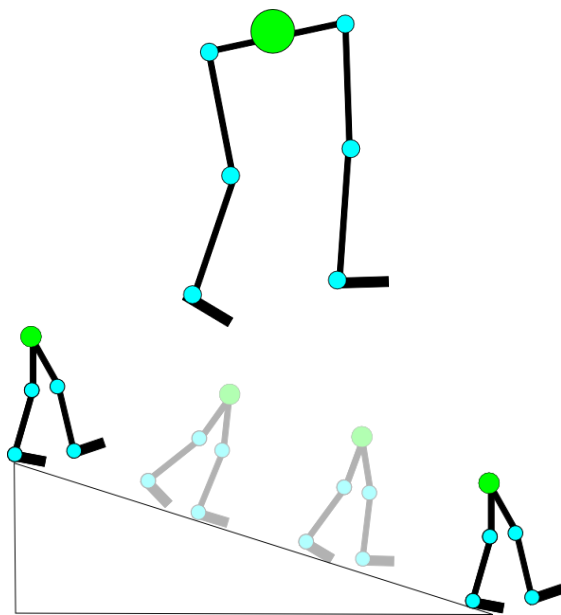
## BDRL-UP-12: Design of a Passive Walker Biped

### Problem Statement

The problem aims to come up with a design of a biped which is able to walk without any actuation or control but only because of gravitational and inertial forces.

### Project Description

In order to understand the nature of bipedal locomotion, passive walkers are simple but effective designs to research the dynamics of the walking gait. In this project you will be asked to firstly understand the dynamics and mechanics of bipedal locomotion, or simply the walking gait. The interesting part of the project is to design and build a biped robot which can walk without any actuation and control. The hard part of the project will be to find a solution to make this possible with only passive joints and a possible additional torso. A sketch of the desired robot would be similar to the following figure:



The biped on the left consists of only the legs along with feet and a torso that connects these legs. You will have to solve the problem of moving your legs one step further without making them hitting the ground while the legs are swinging to the front. For this, you may have to use additional joints on the knees and ankles; however this decision will be based on your design.

On the bright side, to make things simpler for this problem, you are going to use a declined platform to make your robot walk on. In order to involve gravitational force to give your robot a pushing force, such an angled path will be required. A simple figure on left shows you the main idea.

### Expected Project Outcomes

Your projects would be complete if you could make this robot walk down hill without using any actuation and more importantly, without falling on the ground.

### Optional Extras

If you manage to make the robot walk with such a design, you may want to attach a torso to your robot. Working like an inverted pendulum, this upright torso could oscillate in roll or pitch directions to give your robot an additional stability and inertia.

### Desired Skills / Background

Team could be up to 3 participants, preferably ME students. Desires skills would be;

- Knowledge about dynamics and kinematics,
- Mechanical construction experience,

**For more information:** Utku Çulha, [culha@cs.bilkent.edu.tr](mailto:culha@cs.bilkent.edu.tr)