Passive Dynamic Walker

16-311: Introduction to Robotics

Contents

Learning Objectives

1. Be able to describe a passive dynamic walker.
2. Gain exposure to non-traditional robots.
3. Work through the challenges of creating a passive dynamic walker.

1 Research

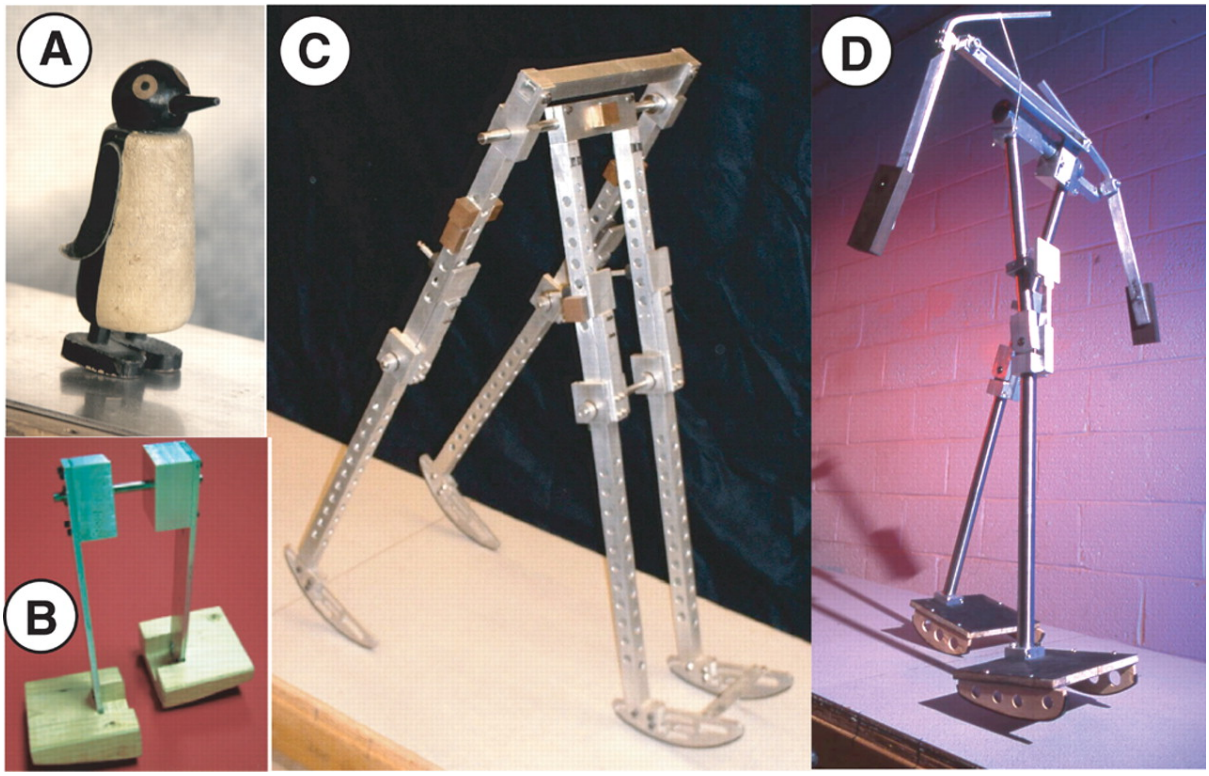

Figure 1: Image from Collins, et al. 2005 `https://science.sciencemag.org/content/307/5712/1082/tab-figures-data`

Look up a few papers and videos on passive dynamic walkers and answer the following questions:

1. What are three elements that you notice in one or more of these robotic systems that you could integrate into your own robot? (For example: a certain shape or mechanical element) [15 points]

2. What do you think will be the biggest challenge in creating your own walker? [5 points]

3. How will you test your system? Is there some way to test your system incrementally instead of just success or failure in the given walking parameters? [5 points]

2 Planning

Based on your research and intuition, create a plan for your system.

1. What materials do you plan to use? [5 points]
2. How many degrees of freedom will your walker have? [5 points]
3. How many legs will your walker have? [5 points]
4. How many joints will your walker have? [5 points]
5. How will you adjust the weight or dimension of your elements? [5 points]

3 Implementation

Create a physical passive dynamic walker with any materials you have access to. This will likely require a good deal of trial and error, so it is alright if your final walker differs from your initial plan. If you have access to rapid prototyping devices, you may use them, but you are not permitted to simply download an existing design from the internet and print/cut it.

Take a video of your walker in action that clearly shows how far it moves. You are allowed to start your walker with a shove or swing. Your robot must walk and not perform some stylized falling or rolling. [50 points if you walker moves at least the length of it's foot in the direction of travel and takes at least five steps total on flat ground. 47 points if your walker takes at least 5 steps and moves at all on flat ground. 45 points if you achieve the 50 point criteria on a slope. 40 points if you achieve the 47 point criteria on a slope. 30 points if your walker is able to stand up by itself and attempts to walk.]

Here are some great videos from 2020 (used with permission): `https://youtu.be/EiyYqnqRu0M`, `https://youtu.be/8KQSfcc8-FE`.

What To Submit

Submissions are due on Gradescope by the date specified in the Syllabus.

1. Create a .pdf file with the written answers ALL THE SECTIONS named pdw.pdf.
2. Ensure that your .pdf contains the answers for Part 1 and 2, and the video for Part 3.