

Hexapod Robot

Aidan Barber, Aidan Vine, Harnoordeep Grewal and Julius Atherton
Faculty of Engineering and Applied Science,
OntarioTech University, Oshawa, Ontario, Canada

Aidan.barber@ontariotechu.net, Aidan.vine@ontariotechu.net, Harnoordeep.grewal@ontariotechu.net, Juilius.atherton@ontariotechu.net

Abstract—This report presents the design, modelling, control, simulation and analysis of an electromechanical system known as a the hexapod using matlab simulink and solid works software. A modeling procedure is described together with analytical formulas to justify our design specifications for the design specifications of the hexapod robot.

Index Terms—Hexapod, Servo, Torque

I. INTRODUCTION

Group 17 was given the task of designing, modeling, simulating and analysing an electromechanical system that includes different aspects of actuators and power electronics. Our group chose the hexapod robot as our choice for the electromechanical system. A hexapod is a robot with parallel kinematic positioning systems consisting of six independent actuator controlled struts or simply put a mechanical vehicle which walks on six legs. Hexapods offer several advantages over other types of mulit-legged walking robots such as being able to maintain statically stable while in motion. A robot is considered to be statically stable when on three or more legs and due to the hexapods legs operating independently of each other it can still operate even when some of its legs become disabled. This combined with the fact that the hexapod acts on a single motion platform helps to eliminate the accumulation of guiding errors and increases precision. Furthermore it means that the hexapod can use its additional legs to gain new foot placements or control a payload. Hexapods are the fastest moving robot with the optimum number of legs for movements as adding more legs does not increase speed. The Hexapod will use a servo motor as its actuating device in order to move the legs. A servo motor is a rotary actuator that allows for precise control of angular position, consisting of a motor coupled to a sensor for feedback, the feedback system increases accuracy and allows the motor to precisely control the rotary motion. The servo motor was selected instead of a stepper because of it's high rate of efficiency, power and torque compared to the stepper, additionally the stepper motor produces high amount of heat when in operation which can lead to issues with the circuitry in the long run. Hexapods are useful for a variety of tasks particularly ones that can be dangerous for humans such as space exploration, undersea cable construction and rescue missions to name just few.

II. DESIGN SPECIFICATION

A. Problem Description

You should have a smooth transition between your Introduction and this section. In this section you should identify the problem you are trying to solve. You should also research the current state of the art: explore if people have already solved the problem, and their respective solutions. The following is an example of how to implement a numbered list:

- 1) Students are not yet informed on how to make a professional IEEE conference paper.
- 2) Students are unfamiliar with L^AT_EX or the TexMaker IDE.

B. Design Requirements

In this subsection, break the problem description down into the fundamental requirements. Your proposed design should meet each of the criteria you create.

- This paper should provide a template for the user.
- This document should showcase the features and functions of the software.

III. MODELING AND SIMULATION

In this section you should fully explain your design. Include any schematics, models or diagrams of the system. Show and explain the results of your simulation or model. Prove that your design meets the requirements laid out earlier. To convey this information utilize the tools described in the following subsection.

A. Equations, Figures and Tables

Number equations consecutively. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

$$i_0 = \frac{\sqrt{2}V_s}{Z} \sin(\omega t - \theta) + \left(I_0 + \frac{E}{R} - \frac{\sqrt{2}V_s}{Z} \sin \theta \right) e^t \quad (1)$$

$$I_0 = \frac{\sqrt{2}V_s}{Z} \sin(\theta) \frac{1 + e^{-(R/L)(\pi/\omega)}}{1 - e^{-(R/L)(\pi/\omega)}} - \frac{E}{R} \quad (2)$$

You can reference the equations above in your document by using their defined label, [1] and [2]. Steady-state: $I_0 =$

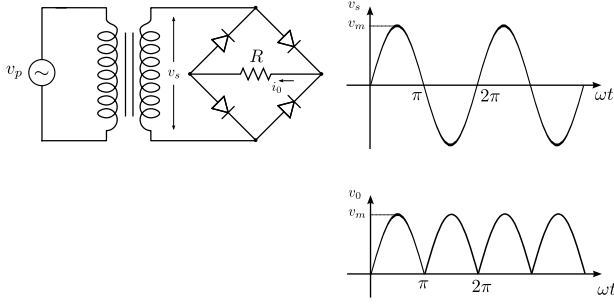


Fig. 1. An example figure. Figure captions should provide sufficient information to understand the image.

$i_o(\omega t = 0) = i_o(\omega t = \pi)$. Individual variables can also be called, such as ω_0 .

TABLE I
TABLE TYPE STYLES

Table Head	Table Column Head		
	Table column subhead	Subhead	Subhead
copy	More table copy ^a		

^aSample of a Table footnote.

Figure Labels: Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”. See examples Fig. 1 and Fig. 2 in this document.

All figures should be clearly explained in the text. Furthermore, all figures should have a purpose, do not include irrelevant or redundant images. Doing so will only make the document more cluttered.

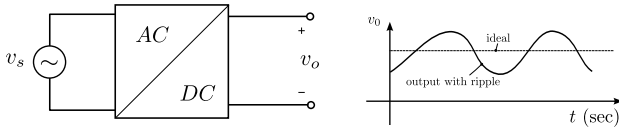


Fig. 2. An example figure. Figure captions should provide sufficient information to understand the image.

B. References

The value outlines how to properly include citations in your report. The sources used are only used in an example context.

Please number citations consecutively within brackets [?]. The sentence punctuation follows the bracket [?]. Refer simply to the reference number, as in [?—do not use “Ref. [?]” or “reference [?]” except at the beginning of a sentence: “Reference [?] was the first . . .”

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was

cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors’ names; do not use “et al.”. Papers that have not been published, even if they have been submitted for publication, should be cited as “unpublished” [?]. Papers that have been accepted for publication should be cited as “in press” [?]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [?].

IV. CONCLUSION AND DISCUSSION

The conclusion should be used to address the success of your design. Answer and discuss if your design met the requirements, had good performance, etc. If applicable, suggest future improvements or applications of the design.