



Integral Kinematics: Training Muscle Control and Performance

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RESEARCH QUESTION

How can integral kinematics be used to develop muscle training, enhance sports performance, and revolutionize the fitness world?

INTRODUCTION

Traditionally, athletic performance is measured using derivatives, or rates of change. While derivatives measure burst, they neglect another key component of athleticism: control. In this research project, we aim to evaluate body control using integrals, or the converse of derivatives

$$\text{Absement} = \int \text{Displacement}$$

Using absement, we aim to invent training devices that measure athletes' absement levels and train maximization of body control.

BACKGROUND AND SIGNIFICANCE

Absement is the integral of displacement, or how long one can hold oneself in a position. This body control is essential in numerous athletic events, such as:



Figure 1: Gymnast requires muscle control to balance delicately on balance beam



Figure 2: Michael Jordan's hang time demonstrates how basketball players need muscle control to contort in mid air



Figure 3: Weightlifters require immense muscle control due to straining positions for lengths of time

Health Benefits of Body Control

- Increased efficiency in ATP consumption
- Decreased risk of bone fractures
- Strengthened immune system
- Augmented muscle mass
- Higher resting metabolic rate

Significance of Research

In the past, body control has always been trained based on qualitative feedback. Using absement, body control is quantifiable for the first time. With more precise feedback, specific training regimes centered around absement can enhance body control.

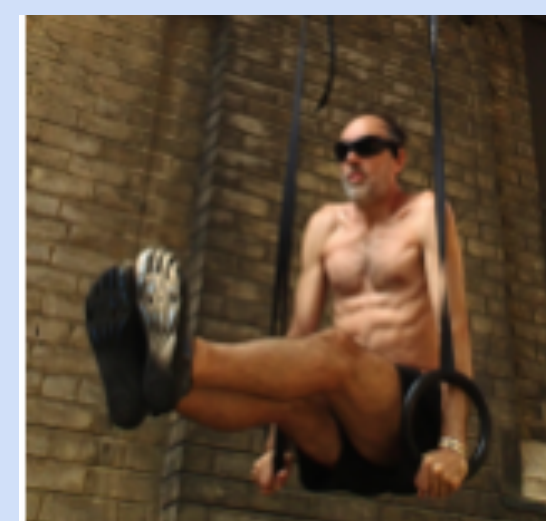


Figure 4: MannFit Ring System measures how long one can hold a position and use absement to train the core muscles

METHODOLOGY

Research absement and inventions that utilize absement for sports training

Brainstorm ideas for a sports training device utilizing absement

Design the mechanism utilizing 3D CAD software

Code an app measuring absement in the sports training device

Conduct an experiment to evaluate athletes' body control using the device

BUILDING THE INVENTION

1. Research

In the beginning, I was unfamiliar with the concept of absement. To effectively utilize it, I had to understand what it is and exactly how it works.



Figure 5: The MannFit Board and its use of a smartphone as a measuring tool for absement was the primary inspiration for my invention

2. Brainstorm

After learning about absement, I decided to build an ab roller to assist athletes. Then, I developed prototypes of my ab roller.

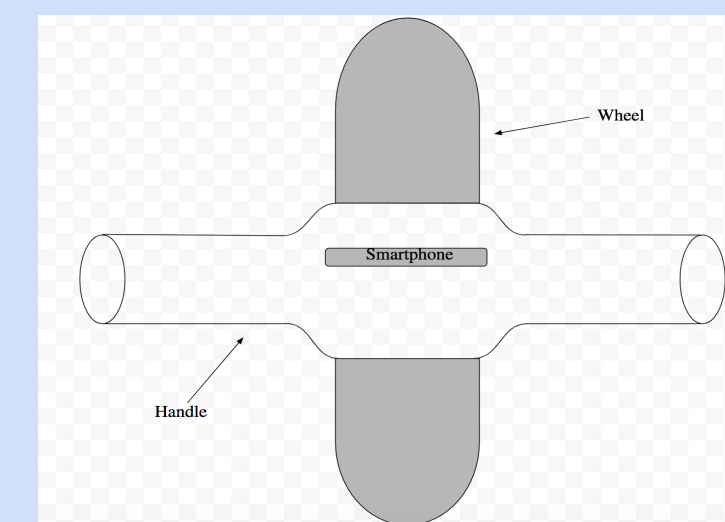


Figure 6: Prototype of Ab Roller The challenge in prototyping the ab roller was finding a place to fit the phone

3. Design

3D printing was used to build the ab roller, because it maximizes the efficiency of its production. To 3D print, a blueprint needed to be designed.

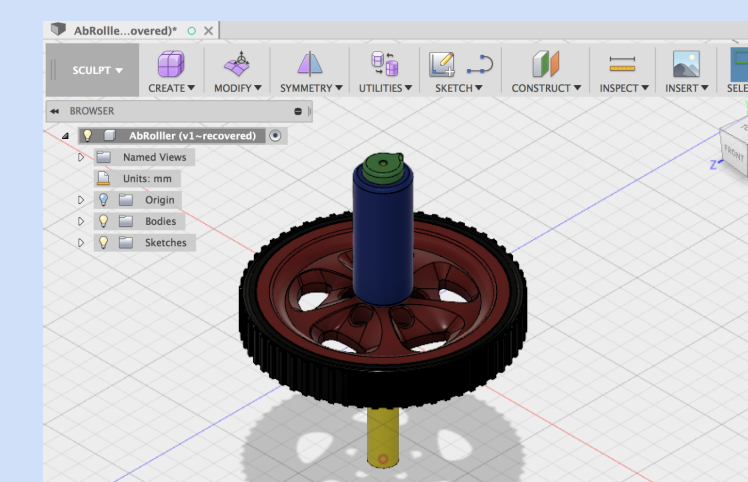


Figure 7: CAD Drawing of Ab Roller Professor Mann and I collaborated on the 3D printing blueprint via the Fusion360 design software

4. Code

The MannFit app calculates absement in the ab roller to provide the user with feedback. To finalize the mechanism, the source code was edited to measure the ab roller's movement to calculate absement.

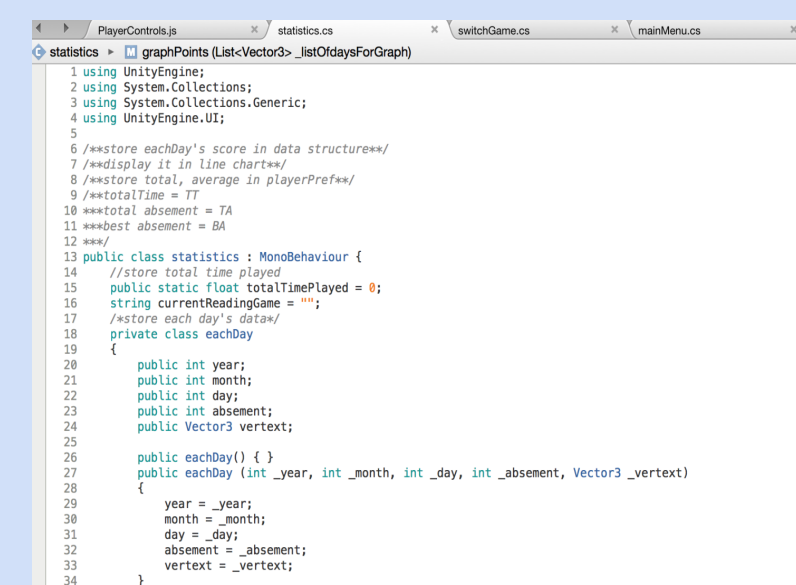


Figure 8: MannFit App Source Code. The MannFit app is able to calculate motion in numerous mechanisms. I needed to edit the code to calculate motion in my ab roller.

CONCLUSION AND CONTINUATION

Following the creation of our absement ab roller, there are numerous ways in which the research project can be extended.

Research Experiment:

- To evaluate the effectiveness of the absement ab roller, we would like to conduct a two sample experiment in which we divide athletes into two groups: those who train muscle control using our integral kinematics equipment and those who train using normal equipment

Data Analysis:

- A 95% Confidence Interval will be used to estimate whether there is a true mean difference between the two groups of athletes
- A Two-Sample t-test of $\alpha = 0.05$ will be conducted to determine if there is a true mean difference between the two groups as well.

Publication:

- If our invention proves to be effective in enhancing muscle control, then we may look to bring it to the market and publish our findings.

ACKNOWLEDGEMENTS / REFERENCES

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