

FYS2150

Lab Report: Time and Frequency

Nicholas Karlsen
(Dated: February 7, 2018)

The goal for this lab was measuring time, and comparing three methods of doing so, of varying degrees of "sophistication"; an hourglass, a stopwatch and a photodiode.

I. INTRODUCTION

The lab spanned 6 hours and consisted of measuring the period of a pendulum using three different methods of measurement; an hourglass, a stopwatch and a photodiode connected to a computer. The experiments were performed by myself, and my lab partner Lars K. Skaarseth. Before anything else, it is worth to note that the first experiment can largely be disregarded due to an error on our part, more on this in section III A.

II. THEORY

The theory used in this lab report is almost entirely summed up by the following equations;

$$T = 2\pi\sqrt{\frac{L}{g}} \quad (1)$$

Where T denotes the period a swinging pendulum, L the length of the wire by which the pendulum is suspended and g the downward acceleration on the pendulum due to gravity.

$$\vec{R} = \frac{1}{M} \sum_i m_i \vec{r}_i \quad (2)$$

Where \vec{R} denotes the position of the center of mass of a body of mass M consisting of several smaller bodies of mass m_i with individual center of mass at r_i .

Further detail can be found in "Elementary Mechanics Using Python" [1], or most other books covering introductory mechanics.

III. EXPERIMENTAL PROCEDURE

A. Hourglass

B. Stopwatch

C. Photodiode

IV. RESULTS

A. Pendulum & Hourglass

Recording no.	Number of oscilations
1	116
2	121
3	128

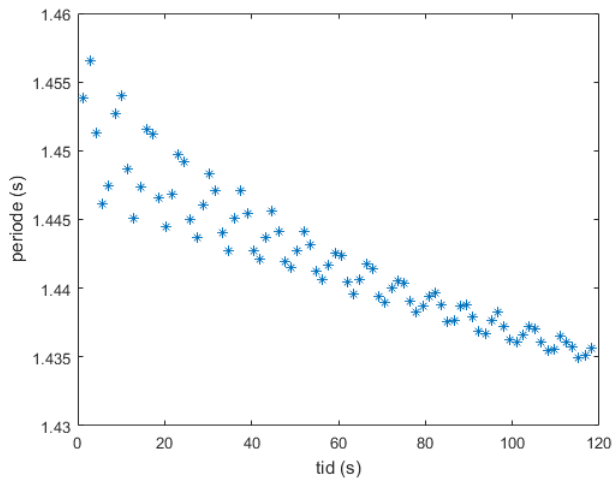
B. Pendulum & Stopwatch

Number of periods	Time [sec]	Total time [min:sec]
10	14.14	14.14
20	14.31	28.53
30	14.32	42.85
40	14.40	57.25
50	14.29	1:11.54
60	14.39	1:25.93
70	14.29	1:40.72
80	14.34	1:54.46
90	14.20	2:08.76
100	14.52	2:23.28

C. Pendulum & Photodiode

Experiment no.	Standard deviation of mean period	Mean period	Position of diode	Total measured time [s]	Measuring frequency [KHz]
1	5.6540e-4	1.4421	Bottom	120	25
2	8.8552e-4	1.4502	Bottom	120	200
3	0.0483	1.5816	top	120	25
4	0.0026	1.4922	Bottom	120	25

Discussing results Discussing results Discussing results

FIG. 1. Data from Experiment no. 1 using the photodiode ^a

^a Due to bad planning on my part, this figure, and the following all lack figure titles.

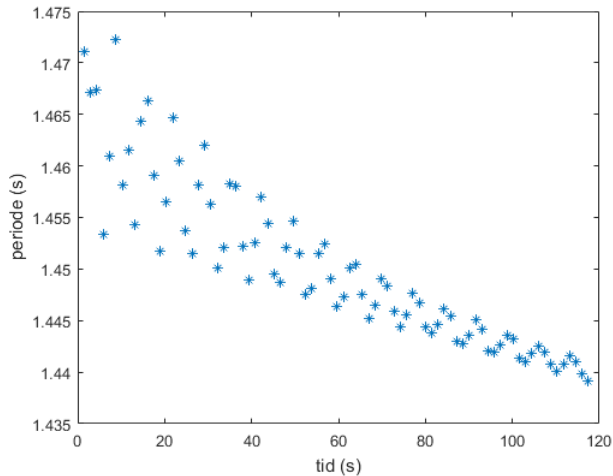


FIG. 2. Data from Experiment no. 2 using the photodiode

Experimenting experiments Experimenting experi-
ments Experimenting experiments Experimenting experi-
ments Experimenting experiments Experimenting experi-
ments Experimenting experiments Experimenting experi-
ments Experimenting experiments

V. DISCUSSION

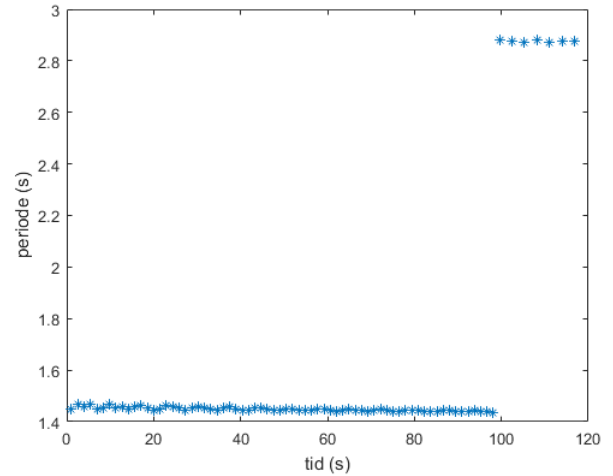
[illegible]

FIG. 3. Data from Experiment no. 3 using the photodiode

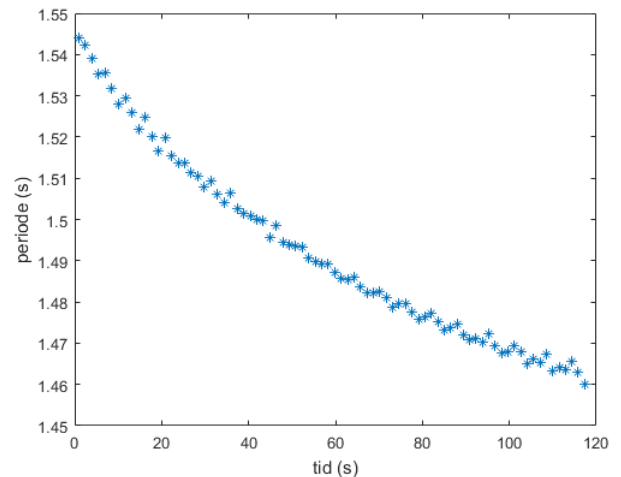


FIG. 4. Data from Experiment no. 4 using the photodiode

Discussing results Discussing results Discussing results
Discussing results Discussing results Discussing results
Discussing results Discussing results Discussing results
Discussing results Discussing results Discussing results
Discussing results Discussing results Discussing results

VI. CONCLUSION

Concluding conclusions Concluding conclusions Con-
cluding conclusions Concluding conclusions Conclud-
ing conclusions Concluding conclusions Concluding con-
clusions Concluding conclusions Concluding conclusions
Concluding conclusions Concluding conclusions Conclud-
ing conclusions Concluding conclusions Concluding con-
clusions

-
- [1] Anders Malthe-Sørensen. *Elementary Mechanics Using Python*. Springer, 2015.