

Writing Style and Standards
in Undergraduate Reports
Third Edition

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CHAPTER 1.5

NARRATIVE REPORTS

Itemized reports are prepared to describe projects that are repetitive and narrowly defined. In contrast, Narrative reports are prepared to describe projects that may be large and whose solutions may not be known in advance. Consequently, a narrative report must be designed to tell the whole story of a project, beginning with the motivation for the work and concluding with a statement of the significance of the conclusions that were obtained.

A narrative report should provide a complete account of your work on a project, with the information subdivided into headed sections as described in Chapter 1.1:

1. Introduction, to describe the goals, related background, and scientific approach
2. Methods, to describe the apparatus, procedures and any benchmarks or models that may be used for comparison purposes
3. Results, to describe measured and analytical results
4. Analysis, provided as a separate section for those projects where significant, separate analysis operations are required
5. Discussion, to evaluate the quality of the results in comparison with benchmarks
6. Closure, to summarize and review the points presented in sections 1-5

In classrooms, this information is typically packaged in a formal report that uses a cover sheet and Table of Contents, as does the example report in Chapter 1.9. However, two variant forms, the Letter Report and the Memorandum Report are often seen. These variant report forms differ mainly in the ways that the author and supervisor are displayed at the head of the report.

In letter reports, as presented in Chapter 1.7, the first page of the report is formatted as a business letter, with the author(s) identified in the letterhead or return address block, and the recipient identified in the addressee block of the letter. The Introduction of the report begins immediately following the letter's salutation statement. The final page of the letter report is expected to provide a closing and signature block, as does a business letter. The letter report format is most commonly used in professional correspondence between consulting engineers and their clients.

In memorandum reports, as presented in Chapter 1.5, the first page of the report is formatted as a formal business memorandum, with TO, FROM, SUBJECT and DATE blocks positioned just above the report's Introduction statement. Memorandum reports are typically used in professional correspondence between engineers and their supervisors. In these

situations, the engineer authors' names are listed beside the FROM heading, the supervisor names are listed beside the TO heading, and report's title is placed on the SUBJECT line.

The differences between letter reports, memorandum reports and formal reports are mainly found in the layout of a document's first page. Using editing software, these format matters can be easily managed, and they may appear to be formalities. However, these formalities concern important information. In filling the authorship, readership, date and title slots at the beginning of a report, you define the lines of responsibility and points of contact. These definitions must be accurate, as they will be carefully examined in the event of a dispute between authors and clients or supervisors.

Narrative reports can vary in size, according to the scope of the project they may describe. Short reports typically describe small projects (or project tasks) that were developed under supervision. If a student happens to work on a faculty member's research project, for example, that student might be given a general goal or a question to answer, and then be left to design and conduct an experiment that meets that goal or answers that question. The short report form is used to describe projects in an intermediate experimentation course.

People prepare long reports to describe large or open-ended projects that have been conducted independently. In such situations, the author of the report is usually the principle investigator on the project, and the report's readers generally are not completely familiar with the project's technical details. Consequently, long reports are common on research projects, even if a supervising faculty member originally assigned the project. As research supervisors, faculty members often find it easier to read complete reports, and from time to time they pass these reports along to colleagues who are less familiar with the particulars of the project. A project report is required as the final submission in most capstone courses, as it presents the results of a student team working over the course of an entire term.

Long reports are appropriate under either of two conditions. First, long reports are appropriate for large and complex projects, for the author may have many procedures to describe, and the author must also explain how all the parts of the project fit together. Second, long reports are necessary for most readers who have not been involved in the daily work of the project. If a student completes a project during one afternoon in a well-supervised lab, then that student probably will not write a long report. If, however, the project was spread across most of a term, then a long report is probably expected.

We will now turn our attention to sections 1.6, 1.7, 1.8 and 1.9, which present long report examples.

CHAPTER 1.6

EXAMPLE OF A SHORT NARRATIVE REPORT IN MEMORANDUM FORMAT

The Standard School of Mechanical Engineering
Genuine Institute of Technology, College Town USA 55511-0001
Undergraduate Instructional Laboratories

TO: Undergraduate Lab Instructional Staff
FROM: Ernest L. Scholar, Section A
SUBJECT: Experiment on the Period of a Pendulum

31 January 2013

Background and Objective

The objective of this experiment was to experimentally measure the period of a simple pendulum and to compare the obtained data with an estimate of the period based on calculations. The experiment was conducted in the instructional lab on 8 January 2013.

Apparatus and Procedure

Apparatus

The pendulum is a locally-fabricated flat steel bar with a drilled hole for the pivot, which is a knife edged shape. The pendulum used for these measurements is identified by Serial No. 3. The dimensions of the pendulum were measured with a Starrett model No.123 vernier caliper, with an uncertainty of .05 mm (.002 inch), and with a True Value MMS425 measuring tape, with an uncertainty of 1 mm (1/32 inch). The period was measured with a Timex Indiglo quartz crystal wrist chronometer. The fractional uncertainty of the chronometer is 6.0×10^{-6} (15 seconds/month [1]).

Procedure

The period of the pendulum was estimated by using the measured values for its dimensions and mass. To experimentally measure the period of the pendulum, the pendulum was placed on a pivot and set in motion. The period was measured by manual timing for four repeated 50-cycle tests. The results and analysis of these tests are given below.

Measurements

Dimensional Measurements

The obtained dimensions of the pendulum were as follows. Using the measuring tape, the overall length was found to be 349 mm. Using the vernier caliper, the thickness was measured to be 13.1 mm, and the width was measured to be 18.86 mm. Also using the vernier caliper, the diameter of the hole was measured to be 19.9 mm, and the distance from the edge of the hole to

Subheads for individual paragraphs are common in practice but are not required for class projects

This is a reference citation using IEEE format

Instruments can be efficiently specified at the time a measurement is introduced

the end of the bar was measured to be 10.0 mm. This pendulum is illustrated, with dimensional measurements, as Figure 1 in Attachment 1.

Measurements of the Period

The period was measured by timing 50 cycles with the wrist chronometer. The timing interval was defined to begin and end when the leading edge of the pendulum passed a small LED light source. The results of four period measurement tests are given in Table 1.

Table 1. Data for four measurements of fifty cycles each

test	time	period
	sec	sec
1	48.16	0.9632
2	48.13	0.9626
3	48.25	0.9650
4	47.76	0.9552
	average =	0.9614
	std dev =	0.0043
	uncertainty of data =	0.014
	uncertainty of average =	0.007

Processing and Analysis

Using the dimensional data presented above, and using the formula presented by Anderson [2], the predicted period of the pendulum was calculated to be 0.9575 sec. Based on the uncertainties of the dimensional data as presented in Table 1, and using the method of Kline and McClintock [3], the uncertainty of the predicted period was found to be 0.0014 sec.

The average period, the standard deviation, and the uncertainty of the period data were computed and are shown in Table 1. The uncertainty of the data, U_{data} , due to random variation was computed using the relatively large coverage factor of 3.2 that applies in this case. The uncertainty of the average was obtained using the standard formula for error propagation analysis, as in Equation 1.

Table numbers and captions are placed above tables

Table entries are best aligned on the decimal point

$$U_{\text{avg}} = \frac{U_m}{\sqrt{N}} \quad (1)$$

where U_m is the uncertainty of measurement and N is the number of measurements. As shown in Table 1, the result of the 50 cycle tests is an average period and corresponding uncertainty of $0.961 \pm .007$ sec.

The results of the theoretical estimate and the three experimental measurements are compared in Figure 1. The experimental period is only 0.4 % higher than the theoretical period, and the theoretical period is well within the experimental error margin. These results demonstrate that the experimental measurement is in good practical and statistical agreement with the theoretical estimate.

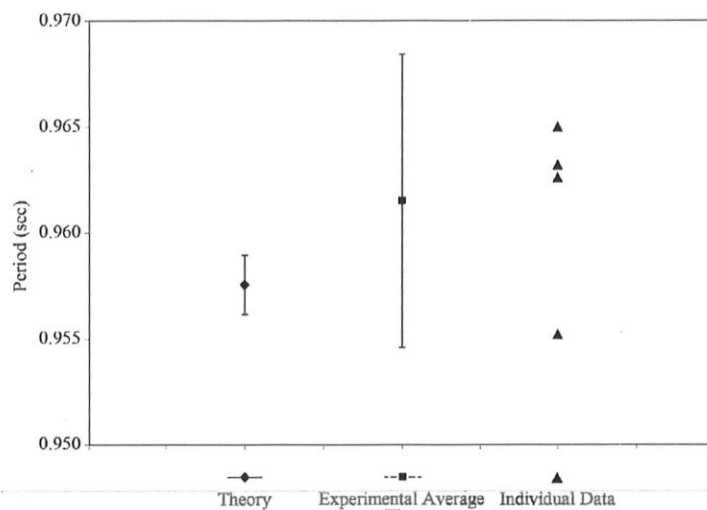


Figure 1. Theoretical and experimental values for period

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When Excel is used to prepare figures, the figure bounding box often creates an untidy blank space. Because this is created by the program, students should consult with their instructors to determine how to manage this blank space

Discussion and Conclusions

Despite the good general agreement between the measured results and the predictions, it is apparent that the experimental measurements tend to be higher than the predicted value. In fact, if the unaccountably low value of 0.9552 obtained on test 4 were excluded, the experimental average would be significantly higher statistically. The predicted values could be too low for at least two reasons: 1) there may be errors in the input dimensional data, or 2) the theory on which the prediction is based may be deficient or incomplete. The first of these reasons can be dismissed; the dimensional measurements are simple and are therefore taken to be reliable. Further, because the LED timer is very accurate, bias error in the experimental measurements is minimized. Consequently, discrepancies between the predicted results and the experimental results must be attributed to physical phenomena that are not accounted for in the simple model that was used to obtain the predicted values. For example, this theoretical model ignores friction, and it is possible that a small but non-zero value of friction could be found at the pivot. Additional experimental data would need to be taken to reduce the random uncertainty in the measurements and resolve this question.

References

- [1] T. Corporation. Instructions: Timex Quartz Digital Chronometer [Online]. Available: <http://www.timex.com/instructions/0861nstr.pdf>
- [2] J. L. Anderson, "Approximations in Physics and the Simple Pendulum," *American Journal of Physics*, vol. 27, pp. 188-189, 1959.
- [3] S. J. Kline and F. McClintock, "Describing uncertainties in single-sample experiments," *Mechanical engineering*, vol. 75, pp. 3-8, 1953.

This reference list uses the IEEE format style

See Chapter 2.6 for more information about reference format and style guides

Attachment 1. Pendulum Diagram

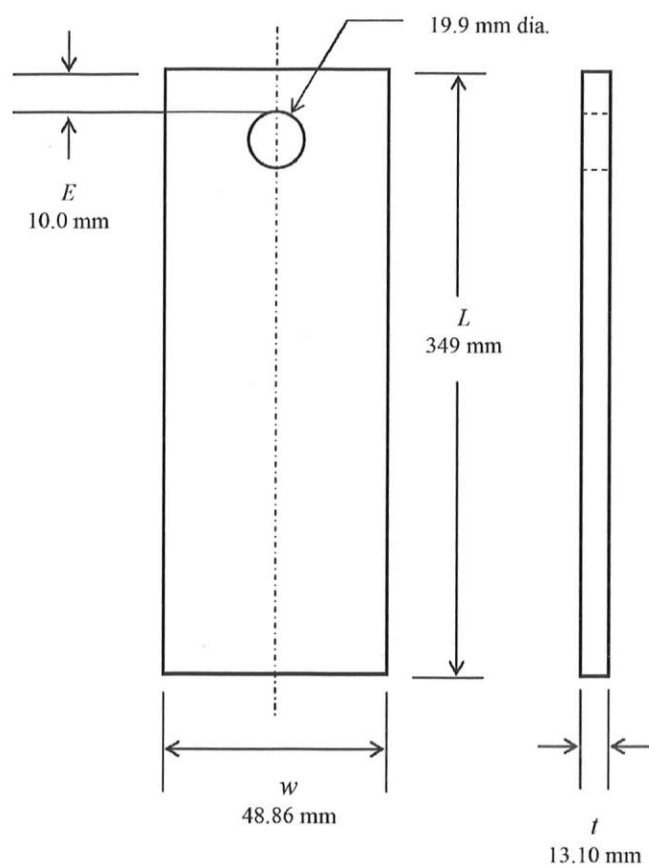


Figure 1. Schematic of the pendulum used in this experiment

Note: not to scale.