



**Autonomous Vehicle Simulation (AVS) Laboratory,
University of Colorado**

Basilisk Technical Memorandum
Document ID: Basilisk-CSS Sensor Data
CSS COMML

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Status: Initial Version
Scope/Contents
The CSS Sensor Data module is responsible for correcting course sun sensor data using a Chebyshev polynomial fit.

Rev	Change Description	By	Date
1.0	Initial Version	J. Martin	20190209

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1 Model Description

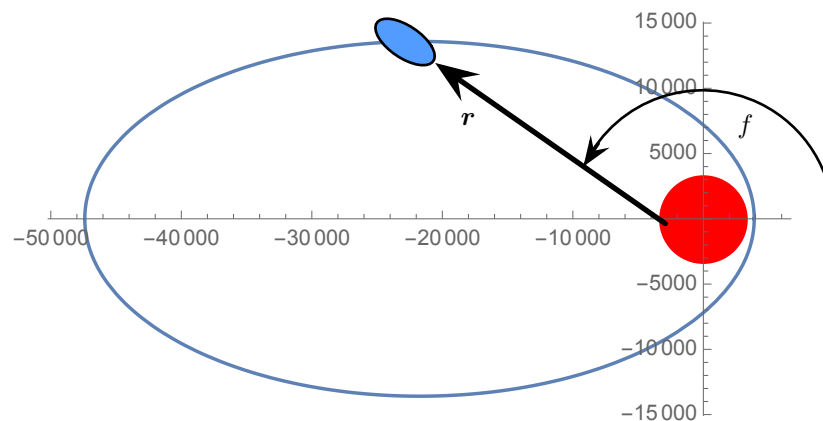


Fig. 1: Sample Figure Inclusion.

This module reads in raw sensor data from the `CSSArraySensorIntMsg`, message type, iterates through each raw CSS measurement, normalizes the measurement, checks that the input is within sensible bounds, and then corrects the measurement by fitting a Chebyshev polynomial to the data. The corrected cosine measurement value is then written out in a `CSSArraySensorIntMsg`.

1.1 Equations

Equations are centered with the equation number flush to the right. In the text, these equations should be referenced by name as Eq. (1) or Equation (1) (e.g., not eq. 1, (1), or Equation 1).

$$a = b^2 \tag{1}$$

1.2 Citation

The citation of bibliographical references is indicated in the text by superscripted Arabic numerals, preferably at the end of a sentence. This is the default style included in this report L^AT_EX class.¹

References listed at the end of the paper are indicated in the text by a superscript Arabic number. If this causes confusion in mathematics or if a superscript is not appropriate for other reasons, this can be expressed as (Ref. 1).

1.3 Figures

Illustrations are referred to by name in the text as Figure 1, Figure 2, etc., or, Figures 3 and 4 (e.g., not figure 1, Fig. 1, or *Figure* 1). Captions are in title case (miniscule lettering with the first letter of major words majuscule); they are 10-point serif font and centered below the figure as shown in Figure 1. Each illustration should have a caption unless it is a mere sketch. An explanatory caption of several sentences is permissible. Each included illustration must be called out (mentioned) in the text. Ideally, figures should appear within the text just before they are called out.

The figure files (PDF preferred) should be stored in a common “Figure” sub-folder. If available, any drawing documents used to create this figure can be stored in a “Support” sub-folder.

1.4 Tables

Tables are referred to by name in the text as Table 1, or, Tables 2 and 3 (e.g., not table 1, Tbl. 1, or Table 1). The title is centered above the table, as shown in Table 2. The minimum number of lines needed for clarity is desired. The table font may be adjusted smaller than the body text as necessary.

Table 2: A Caption Goes Here

Animal	Description	Price (\$)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33
Armadillo	frozen	8.99

1.5 Mathematical model

There can be subsections, like this one.

1.5.1 Gravity models

Even subsubsections.

2 Module Functions

This section will contain a bullet-list and descriptions of what functions this module performs. For example:

- **Calculate A Thing:** This module calculates a thing with great precision
- **Communicate Something:** This module interfaces with X, Y, and Z via the messaging system.

3 Module Assumptions and Limitations

This section should describe the assumptions used in formulating the mathematical model and how those assumptions limit the usefulness of the module.

4 Test Description and Success Criteria

Describe the unit test(s) in here.

4.1 Check 1

There could be subsections for various checks done within the unit test.

5 Test Parameters

Test and simulation parameters and inputs go here. Basically, describe your test in the section above, but put any specific numbers or inputs to the tests in this section.

The unit test verify that the module output guidance message vectors match expected values.

Table 3: Error tolerance for each test.

Output Value Tested	Tolerated Error
outputVector	1e-12

6 Test Results

The results of the unit test should be included in the documentation. The results can be discussed verbally, but also included as tables and figures.

All of the tests passed:

Table 4: Test results

Check	Pass/Fail
1	PASSED
2	PASSED
3	PASSED

6.1 Unit Test Table Results

To automatically create a unit test table to include in the documentation, use the command:

```
unitTestSupport.writeTableLaTeX(
tableName,
tableHeaders,
caption,
dataMatrix,
path)
```

Here are the sample \TeX table form the unit tests.

6.2 Unit Test Figure Results

If figures and plots are generated in the python unit tests, these can be also automatically included in the unit test documentation. This is achieved with the command:

```
unitTestSupport.writeFigureLaTeX(
"testPlot",
```

Table 5: Sample output table for param1 = 1 and param2 = 1.

time [s]	Output 1	Error	Output 2	Error	Output 3 r	Error
0	2	0	1	0	0.7	0
0.5	3	0	1	0	0.7	0
1	4	0	1	0	0.7	0
1.5	2	0	1	0	0.7	0
2	3	0	1	0	0.7	0

Table 6: Sample output table for param1 = 1 and param2 = 3.

time [s]	Output 1	Error	Output 2	Error	Output 3 r	Error
0	2	0	3	0	0.7	0
0.5	3	0	3	0	0.7	0
1	4	0	3	0	0.7	0
1.5	2	0	3	0	0.7	0
2	3	0	3	0	0.7	0

"Illustration of Sample Plot",
 plt,
 "width=0.5\\textwidth",
 path)

7 User Guide

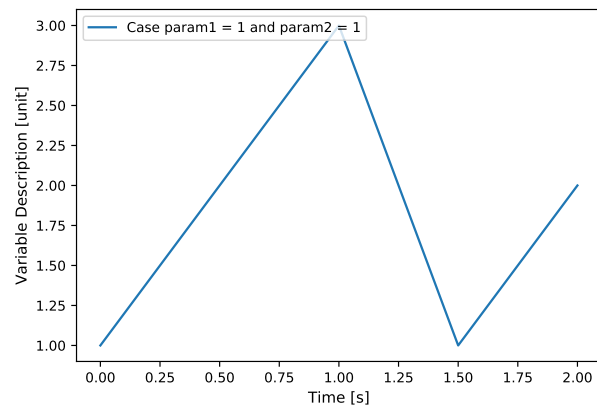
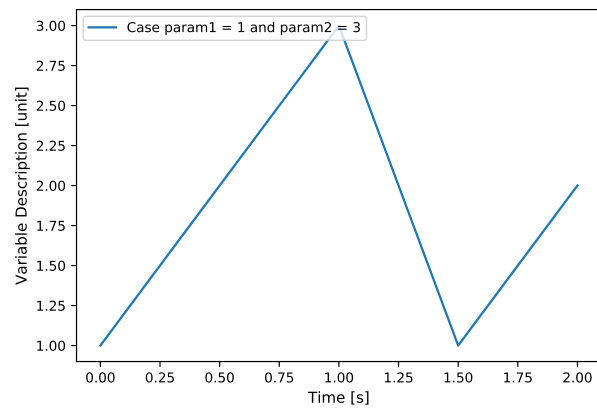
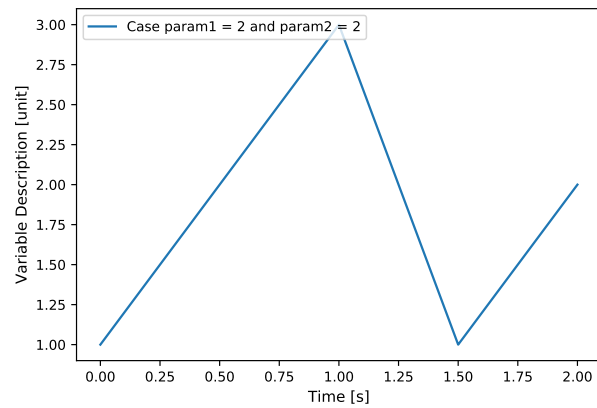
This section contains information directed specifically to users. It contains clear descriptions of what inputs are needed and what effect they have. It should also help the user be able to use the model for the first time.

REFERENCES

- [1] Samuel Pines. Uniform representation of the gravitational potential and its derivatives. *AIAA Journal*, 11(11):1508–1511, 1973.

Table 7: Sample output table for param1 = 2 and param2 = 2.

time [s]	Output 1	Error	Output 2	Error	Output 3 r	Error
0	3	0	2	0	0.7	0
0.5	4	0	2	0	0.7	0
1	5	0	2	0	0.7	0
1.5	3	0	2	0	0.7	0
2	4	0	2	0	0.7	0

**Fig. 2:** Illustration of Sample Plot**Fig. 3:** Illustration of Sample Plot**Fig. 4:** Illustration of Sample Plot