Enter only names of Teammates who are present to work on this Milestone.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Teammate FNs:** |  |  | | |  | |  |
| **Purdue Logins:** |  |  | | |  | |  |
| **Section Number:** |  | |  | **Team Number:** | |  | |

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| **Read these Instructions:**   1. Read through this Milestone before beginning your work so you understand its scope. Also, carefully read the contributions sections so you understand what is expected of each teammate. 2. Save this answer sheet as **M2\_*sss*\_*tt*.docx** where ***sss*** is your section number (07, 14, or 15) and ***tt*** is your team number (e.g., 03 for team 3).    * Make sure all teammates have copies of all submitted project files all the time. 3. Cite your sources in APA format with (1) an in-text citation where referenced in the body of the text **and** (2) a full citation in the Reference section of this Milestone. As a reminder, it would be an example of **Academic Dishonesty** if you don’t include in-text citations and references. 4. FOR UPLOAD TO Bb prior to Class 26   Compress all deliverables listed into one zip file named M2\_sss\_tt.zip   * + M2\_sss\_tt.docx   + M2Alg1\_sss\_tt.m   + M2Alg2\_sss\_tt.m   + M2Calibration\_sss\_tt.m   + M2AlgExec\_sss\_tt.m   + M4\_TechBrief\_sss\_tt.docx   This zipped file ***must*** contain M2 and M4 ***along with*** your ***four*** MATLAB m-files  Submit the zipped file to the M2 Drop Box on Bb prior to Class 26.   * Only one submission of the zip file with all documents is required per team. * Only the last submission will be graded; make sure all deliverables are submitted at the same time.  1. BRING A COMPLETE SET OF THESE DOCUMENTS to Class 26   All docs (Milestones **and** Matlab code) should be double-sided printed stapled  For M4 iterations, use ***CAPS BOLD ITALIC*** to identify corrections from your prior version  For .m files, use “format compact” to suppress the display of blank lines |

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| **Particular Learning Objectives are highlighted throughout the document. However, all LOs that you have encountered throughout the semester may apply (where appropriate) to your work on the Milestones.** |

**Part 0: M1 Feedback Review**

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| **Learning Objective (LO): 22.00 Reflect on feedback for the purpose of improvement**  ***Evidence of Proficiency Requires*:**   * Feedback summarization is clear and useful * Response plan is clear and practical |

1. In your own words, summarize the feedback you received on project milestone M1 that could lead to improvements in your work.

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| <*insert your answer here*> |

1. Based on your feedback, what do you need to do to improve your parameter identification approaches? (Do not just reword your response to Part A. Consider how you will incorporate your feedback into your work.)

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| <*insert your answer here*> |

**Part 1: Algorithm Development**

1. In Milestone 1, you developed two approaches for identifying ts (Approaches 1A and 1B) and two approaches for identifying τ (Approaches 2A and 2B) that were the most promising. Now, you will create two complete algorithms for full parameter identification (yL, yH, ts, and τ). You will mix and match your best ideas for identifying ts and τ and add your best ideas for identifying yL and yH to make ***two different algorithms***. Then, you will develop a flowchart and a user-defined function for each algorithm.

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| **Learning Objective (LO): 15.00 Construct and troubleshoot a flowchart using standard symbols and pseudocode (this includes all appropriate sub-LOs)** |

Each flowchart must:

* be clear and use the correct symbols filled with English text (not code)
* clearly indicate inputs and outputs
* provide sufficient details (steps) for computing all four key parameters (yL, yH, ts, and τ) ***with no user intervention***
* provide a means of computing the parameters for ***both heating and cooling data***

Remember, flowcharts are a thinking tool for developing and organizing your algorithm ***before*** you code. A well-developed flowchart reduces coding frustrations.

It is highly recommended that you produce your flowcharts using a computer tool.

**Algorithm 1 Flowchart:**

<*insert your flowchart here*>

**Algorithm 2 Flowchart:**

<*insert your flowchart here*>

1. Once you have completed the flowcharts, translate your flowcharts into two user-defined functions named **M2Alg1\_*sss*\_*tt*.m** and **M2Alg2\_*sss*\_*tt*.m**

|  |
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| **Learning Objective (LO): 11.00 Create and execute a user-defined function (this includes all appropriate sub-LOs)** |

As you develop your algorithm UDFs, keep in mind that they will be called by an executive function (see Part 2.C. in the next section). The executive function will load the time-history data that needs to be analyzed, call your two algorithms, and plot the results. As such, you must carefully consider what the input and output arguments need to be for your algorithm UDFs.

***Note:*** For all the code you write for this project, each teammate is expected to write an equal share of code and record that teammate’s name in the comments for the lines of code (ie, appropriate comment, code: Samantha). If a teammate’s portion of the code has errors, that same teammate is expected to fix his/her errors in the code. If a 2nd teammate has to correct the code, the 2nd teammate needs to add his/her name to the line of code after the original coder’s name (ie, appropriate comment, code: Samantha, edits: Julia). In the contribution section, each teammate will identify the lines of code he/she developed. This tracking mechanism will help ensure that each teammate’s contributions are comparable.

**Part 2: Output Comparison**

1. Use your two algorithm user-defined functions to process the four calibration datasets provided to you: both the ‘clean’ and ‘noisy’ datasets for both the heating and cooling conditions. Report the parameters identified by your algorithms in Table1 and Table 2. **Be sure to include appropriate units and decimal places throughout the tables**. The **actual** parameter values for the calibration datasets are provided for comparison.

***Note:*** Ignore the SSEmod row of the tables; you will complete this in Part 2.B.5.

**TABLE 1. Heating Condition**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | |  | | **HEATING** | |
| Parameter | Your Algorithm 1 | | Your Algorithm 2 | | Actual Values | |
| Clean | Noisy | Clean | Noisy | Clean | Noisy |
| yL |  |  |  |  | 0.25 oC | -0.45 oC |
| yH |  |  |  |  | 99.13 oC | 99.42 oC |
| ts |  |  |  |  | 1.37 sec | 1.84 sec |
|  |  |  |  |  | 0.21 sec | 1.35 sec |
| SSEmod |  |  |  |  |  |  |

**TABLE 2. Cooling Condition**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | |  | | **COOLING** | |
| Parameter | Your Algorithm 1 | | Your Algorithm 2 | | Actual Values | |
| Clean | Noisy | Clean | Noisy | Clean | Noisy |
| yH |  |  |  |  | 101.95 oC | 98.65 oC |
| yL |  |  |  |  | -1.89 oC | 0.14 oC |
| ts |  |  |  |  | 1.02 sec | 1.93 sec |
|  |  |  |  |  | 1.92 sec | 1.03 sec |
| SSEmod |  |  |  |  |  |  |

1. In a separate user-defined function called **M2Calibration\_*sss*\_*tt*.m**, examine how well the **actual** parameter values for the calibration datasets, when plugged into the piecewise equations (1) and (2) from the project description document, model the ‘clean’ and ‘noisy’ datasets for both heating and cooling. Create two 2 x 1 plots in MATLAB (suitable for technical presentation, with appropriate attention to axis labels, legends, etc.), with:

**Figure 1:**

* 1. Upper: plot the ‘clean’ HEATING calibration data and overlay the piecewise model generated using equation (1) from the project description document with the actual parameter values for the ‘clean’ heating calibration dataset. Use different line styles and colors with no data markers for the ‘clean’ data and the model.
  2. Lower: plot the ‘noisy’ HEATING calibration data and overlay the piecewise model generated using equation (1) from the project description document with the actual parameter values for the ‘noisy’ calibration dataset. Use different line styles and colors with no data markers for the ‘noisy’ data and the model.

**Figure 2:**

* 1. Upper: plot the ‘clean’ COOLING calibration data and overlay the piecewise model generated using equation (2) from the project description document with the actual parameter values for the ‘clean’ cooling calibration dataset. Use different line styles and colors with no data markers for the ‘clean’ data and the model.
  2. Lower: plot the ‘noisy COOLING calibration data and overlay the piecewise model generated using equation (2) from the project description document with the actual parameter values for the ‘noisy cooling calibration dataset. Use different line styles and colors with no data markers for the ‘noisy data and the model.

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| **Learning Objective (LO): 07.00 Create and evaluate x-y plots suitable for technical presentation (this includes all appropriate sub-LOs)** |

<*insert Figure 1 here*>

<*insert Figure 2 here*>

* 1. To get a feel for a possible target for the error between time histories and their models, compute a ‘modified’ SSE for the ‘clean’ and ‘noisy’ heating and cooling datasets and place the values in the SSEmod row in Table 1 and Table 2.

The ‘modified’ SSE calculation normalizes (i.e., divides) the SSE calculation you saw when we studied regression by the number of data points *n*, yielding an average error per data point:

In this case, the *yi* are the data points from the ‘clean’ or ‘noisy’ dataset, and the *f*(*x*) is the piecewise equation that defines a first-order response [heating or cooling; equations (1) and (2) from the project description document] using the parameters given in the table for the calibration data sets.

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| **Learning Objective (LO): 12.03 Manually compute the SSE (noting the SSEmod is a bit different as described above)** |

1. In a separate user-defined function, **M2AlgExec\_*sss*\_*tt*.m**, examine how well **your** parameter values for the calibration datasets, when plugged into the piecewise equations (1) and (2) from the project description document, model the ‘clean’ and ‘noisy’ heating and cooling calibration datasets. This function must load the data, call your two algorithms, and plot the results.
   1. Repeat the plotting steps (steps 1-4) of Part2.B using the parameters identified by your algorithms.

**Algorithm 1 Plots:**

<*insert Figure 1 here*>

<*insert Figure 2 here*>

**Algorithm 2 Plots:**

<*insert Figure 1 here*>

<*insert Figure 2 here*>

* 1. For each algorithm, consider the ‘clean’ calibration dataset plots (both heating and cooling) generated using the parameters that you identified. In the boxes below, describe similarities and differences in the shapes of the ‘clean’ dataset and your model for the two ranges of the piecewise function: t<ts and t≥ts.

|  |
| --- |
| **Algorithm 1 ‘clean’ dataset plot observations of heating and cooling**  For t<ts  <*insert your answer here*>  For t≥ts  <*insert your answer here*> |

|  |
| --- |
| **Algorithm 2 ‘clean’ dataset plot observations of heating and cooling**  For t<ts  <*insert your answer here*>  For t≥ts  <*insert your answer here*> |

* 1. For each algorithm, consider the ‘noisy’ calibration dataset plots (both heating and cooling) generated using the parameters that you identified. Do you notice any differences in the shapes of the ‘noisy’ dataset and your model? Briefly describe and explain what you see in the boxes below.

|  |
| --- |
| **Algorithm 1 ‘noisy’ dataset plot observations of heating and cooling**  For t<ts  <*insert your answer here*>  For t≥ts  <*insert your answer here*> |

|  |
| --- |
| **Algorithm 2 ‘noisy’ dataset plot observations of heating and cooling**  For t<ts  <*insert your answer here*>  For t≥ts  <*insert your answer here*> |

* 1. For each algorithm, compute the SSEmod values for the ‘clean’ and ‘noisy’ calibration datasets, and insert those values in Table 1 and Table 2.

**Part 3: Observations and Improvements**

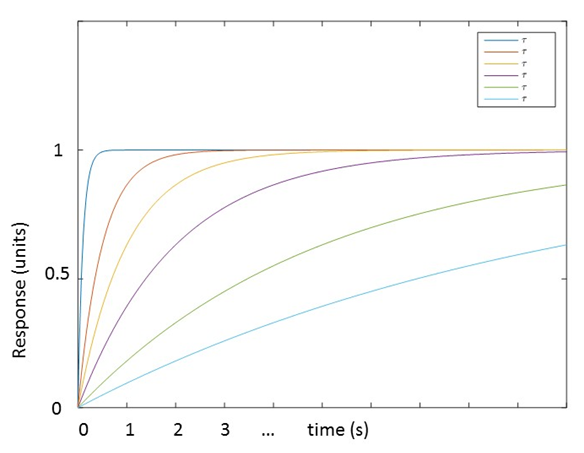
Based upon your observations of your plots and the SSEmod results for your models, suggest at least two ways you believe each algorithm could be improved. Briefly explain each suggestion in the Algorithm Improvements Tables below. You do not need to code these changes; at this point, simply describe the changes you think might improve your results.

Be sure to:

* explain which parameter(s) your improvement will target,
* explain the improvement with a level of detail that can be understood by others (provide sketches or flowcharts as necessary to clarify your improvement),
* describe the metrics you will use to determine whether your proposed improvement really does improve your solution, and
* provide evidence-based rationales for each proposed improvement and the metrics selected. Your rationales should answer the questions, what is your evidence that this:
  + improvement is necessary?
  + method for making the improvement is a good idea?
  + metric is a good idea?

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| **Learning Objective (LO): 21.02 Communicate ideas clearly and concisely**  ***Evidence of Proficiency Requires:***   * Purpose of communication is clear * Improvements are fully but concisely described   + All steps are included   + Appropriate technical language is used   + Clarifying images (e.g., sketches, graphs and/flow charts) are provided (as necessary) * External research is accompanied by an in-text citation and full reference |
| **Learning Objective (LO): 21.03 Evaluate model or algorithm development (e.g. ideas, work, functionality) using evidence-based rationales**  ***Evidence of Proficiency Requires:***   * Assumptions, claims, and critical decisions are clearly stated * An appropriate source of evidence is used to support assumptions, claims, and critical decisions * The evidence is clearly articulated * External research is accompanied by an in-text citation and full reference |

***Although the focus is for you to identify improvement that resolve issues that your current algorithms have, if based on your calibration analysis you feel that you do not need to make changes to your algorithm, you should start thinking ahead to the data sets you will work with in M3.*** What if it takes a long time to reach the new steady state as in **Figure 1** below (i.e., purple, green, and blue lines)? What if steady state was never reached during data collection (i.e., green and blue lines)?



**FIGURE 1**

**Algorithm 1 Improvements** (add additional Improvement blocks as needed)

|  |
| --- |
| **Improvement 1. Parameter(s) Targeted: \_\_**<*declare parameter(s) here*>**\_\_\_** |
| Description  <*insert your answer here*> |
| Metrics to Determine Improvement  <*insert your answer here*> |
| Rationale for Improvement and Metrics  <*insert your answer here*> |

|  |
| --- |
| **Improvement 2. Parameter(s) Targeted: \_\_**<*declare parameter(s) here*>**\_\_\_** |
| Description  <*insert your answer here*> |
| Metrics to Determine Improvement  <*insert your answer here*> |
| Rationale for Improvement and Metrics  <*insert your answer here*> |

**Algorithm 2 Improvements** (add additional Improvement blocks as needed)

|  |
| --- |
| **Improvement 1. Parameter(s) Targeted: \_\_**<*declare parameter(s) here*>**\_\_\_** |
| Description  <*insert your answer here*> |
| Metrics to Determine Improvement  <*insert your answer here*> |
| Rationale for Improvement and Metrics  <*insert your answer here*> |

|  |
| --- |
| **Improvement 2. Parameter(s) Targeted: \_\_**<*declare parameter(s) here*>**\_\_\_** |
| Description  <*insert your answer here*> |
| Metrics to Determine Improvement  <*insert your answer here*> |
| Rationale for Improvement and Metrics  <*insert your answer here*> |

**REFERENCES (written in APA format – see Word>reference>manage sources>new tab)**

List your References used in evidence-based rationales for this Milestone. Also, copy and paste them into your M4 Tech Brief Reference Section.

|  |
| --- |
| Example (reference for an internet source):  Author Last, X. (year). Title xxxx xxx xxxx. Retrieved from http://www.url.xxx/xxxx/xxxx |
|  |

**M4 TECHNICAL BRIEF**

Open your Technical Brief document, ***M4\_TechBrief\_sss\_tt*.docx**, and review the instructions, components, and requirements of this document. Once you complete M2, reread Part 1 Section A and make corrections in ***CAPS BOLD ITALIC***. You will always make correction in ***CAPS BOLD ITALIC***. Then write Part 1 Section B and Part 2. Resave your M4\_TechBrief with your same document name, ***M4\_TechBrief\_sss\_tt*.docx**.

**INDIVIDUAL CONTRIBUTIONS on PROJECT**

**Part 1: Rate Self on Specific Criteria**

Write each teammate’s name in a separate column. Each teammate must **score** just your *own* behaviors during *this* Milestone. Indicate the extent to which he/she agrees with the statement on the left using a scale of 1-4 (1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree). Each teammate totals the numbers in own column. As a reminder, it would be an example of **Academic Dishonesty** if you record a false evaluation of your work for this Milestone.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Teammates Names:  Evaluation Criteria: | TM1: | TM2: | TM3: | TM4: |
| Came to classes prepared to work on current Milestone. |  |  |  |  |
| Was not distracted any time during class (phone, text, other hw, etc). (ONLY a 1 or 4) |  |  |  |  |
| Contributed meaningfully to team discussions and coding progress in class. |  |  |  |  |
| Demonstrated a cooperative and supportive attitude in class. |  |  |  |  |
| Attended team meeting(s) and arrived on time.  (ONLY a 1 or 4) |  |  |  |  |
| Came to team meeting prepared with assigned work completed and gave 100% during meeting. |  |  |  |  |
| Contributed meaningfully to team discussions and coding during team meeting. |  |  |  |  |
| Was not distracted any time during meeting (phone, text, other hw, etc). (ONLY a 1 or 4) |  |  |  |  |
| Demonstrated a cooperative and supportive attitude during team meeting. |  |  |  |  |
| Provided assigned code and answers to this Milestone on time and in a quality manner. |  |  |  |  |
| List specific range of lines of code you wrote *on your own*. Remember to write your name in the comments of your program. |  |  |  |  |
| Completed equal portion of this week’s Milestone. |  |  |  |  |
| If corrections were made to the code, added 2nd teammate’s name in the comments of edits made to original coder’s lines of code. (ONLY a 1 or 4 or N/A) |  |  |  |  |
| **TOTALS** |  |  |  |  |

Exceptions:

* If you feel your teammate's scoring is not accurate or a teammate contributed extremely little or a lot more to this milestone, please talk to your Instructor/GTA in class or send an email to your Instructor so we can help resolve any issues or imbalanced workload.

**Part 2: Describe Specific Contributions**

**Individually**, also **write** just your *own* specific task-oriented and detailed description of what you contributed to *this* Milestone. As a reminder, it would be an example of **Academic Dishonesty** if you write false contributions of your work for this Milestone or if you write the contributions for another Teammate, so only write your own contributions. Sign your name in your cell verifying true authorship of your work.

Teammate name Contributions (described in detail)

|  |  |
| --- | --- |
| TM1 Name |  |
| TM2 Name |  |
| TM3 Name |  |
| TM4 Name |  |

Exceptions:

* If a teammate did not contribute in class or at a team meeting, then the space next to that teammate’s name should be left blank and an appropriate grade will be assigned.
* If a teammate does not write anything, then that will represent having not contributed to the milestone and an appropriate grade will be assigned.
* If you feel your teammate's description is not accurate or a teammate contributed extremely little or a lot more to this milestone, please talk to your Instructor/GTA in class or send an email to your Instructor so we can help resolve any issues or imbalanced workload.

**DELIVERABLES BY CLASS 26**

**ELECTRONIC – upload to M2 Dropbox on Bb by Class 26**

In the same submission, upload a zipped file that contains:

* M2\_*sss\_tt*.docx
* M2Alg1\_*sss*\_*tt*.m
* M2Alg2\_*sss*\_*tt*.m
* M2Calibration\_*sss*\_*tt*.m
* M2AlgExec\_*sss*\_*tt*.m
* M4\_TechBrief\_*sss\_tt*.docx (update Part 1A (if necessary) and complete Part 1B and Part 2)

**HARD COPIES – bring a set of these documents to Class 26**

All docs (Milestones **and** Matlab code) should be double-sided printed stapled

For M4 iterations, use *CAPS BOLD ITALIC* to identify corrections from your prior version

For .m files, use “format compact” to suppress the display of blank lines

* M2\_*sss\_tt*.docx
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* M2Calibration\_*sss*\_*tt*.m
* M2AlgExec\_*sss*\_*tt*.m
* M4\_TechBrief\_*sss\_tt*.docx (update Part 1A (if necessary) and complete Part 1B and Part 2)

These documents will be graded **in** **Class 26** and returned to you with feedback.