

CruiseAuto Project – Milestone 1B

INSTRUCTIONS: Parameter Identification Brainstorming

Introduction

General Instructions

Read this document carefully. It provides you with all the requirements needed to complete the M1B Answer Sheet and any coding tasks. You are responsible for following all instructions in this document to complete your work. Use professional language in all written responses. [See EPS01 for guidelines \[link\]](#). You will submit all deliverables to Gradescope.

Using & Citing External Resources

When external sources are used, each must be properly cited with (1) an in-text citation referenced in the body of the text and (2) a full citation in *Part 6. References* of the M1B Answer Sheet for each part of this milestone document. [Use APA 7th style \[help link\]](#). **You will need at least one citation for each of the sections of Parts 4 & 5.**

Milestone 1B Context

Parameter identification is about determining model parameters from available data. This milestone requires you to think carefully about different potential parameter identification approaches, the process of using/coding those approaches, and the consequences of those choices.

Your task is to generate multiple concepts for the fully automated identification of parameters using first-order data from ACC speed tests. You should use evidence-based rationales when evaluating your ideas. In this context, “evidence-based” means you should refer to the graph of the provided data (as a representation of actual data) along with your knowledge of MATLAB and other trusted sources when evaluating your ideas.

This project can be completed using only MATLAB commands that have been taught or used in class materials; however, MATLAB has a huge library of built-in functions that can be very useful. In future milestones, you will be able to utilize these functions to fine tune your algorithm, **but in this milestone, you are only to use functions learned in class.**

Milestone 1B Instructions

Part 1: Assignment Header

Complete the following on Page 1 of the M1B Answer Sheet.

Team Information

The assignment header must contain the section number and team ID, team member names, Purdue career account username, and programmer number for each team member in Part 1. *If you are in section 001 and team 3, your section and team ID (SSS_TT) would be 001_03.*

Milestone Work Report

In the Detailed Description of Work column, each person on the team should write their own description of how they contributed to this milestone. Be very detailed here. Then in the last column, your team should estimate the percentage of the work that each team member did on this milestone. **This column needs to add up to 100%.** We know this will vary on any given milestone, but one person in the team should not be doing significantly more than the others throughout the whole project. Use this column as a way for you to make sure your workload is balanced throughout the project.

Part 2. Milestone 1A Feedback and Reflection

Based on your feedback from M1A, identify at least one strength and one limitation of your team's approach or process you created in M1A. Consider how the feedback from M1A could lead to improvements in your work. Your reflection should provide a clear, useful summary of your M1A feedback and provide a clear and practical plan to address the issues. Use professional written language to record your answers in Part 2. Milestone 1A Feedback and Reflection of the M1B Answer Sheet. Document any references in Part 6 of the M1B Answer Sheet.

Part 3. Examine the Data

Your team now needs to analyze CruiseAuto's data. Using your team's skeleton program from M1A, start implementing the algorithm choices you made in M1A for handling datasets of various sizes as well as visualizing the data. Incorporate any feedback received on M1A. Implement these changes into the main function of the skeleton structure from M1A. The guidelines below will give you additional information on what to include in your main function. Once the function has been coded and the figure(s) generated, save and upload all figures in *Part 3. Examine the Data* of the M1B Answer Sheet.

Primary Programmer: Programmer 1

File Naming Convention: Name the m-file `M1B_main_SSS_tt_login.m`, where `SSS_tt` is your section-team number, and `login` is Programmer 1's career account username.

Team Collaboration: While Programmer 1 will be the primary author and responsible for typing out the code, all team members should assist to ensure the code and its output are professional and readable.

Function Requirements:

Write a no-input, no-output function that will:

- Load the data
- Assign variables
- Plot the different tests using professional formatting

Plotting Guidelines:

- Represent the data with lines and without markers (due to the large number of data points and the time series nature of the data).
- Ensure the plots are neither too few nor too many, allowing clear visualization of the necessary data.
- Keep in mind that this function will eventually be adapted into a main function for the parameter identification process in M2.

Programming Standards:

- Adhere to ENGR 132 programming standards [\[help link\]](#) and plot formatting guidelines [\[help link\]](#).
- Use only MATLAB commands that have been taught or used in class materials for this milestone.

Part 4. Brainstorm & Evaluate Coding Processes Using Experimental Data

In an ideal world, you would be able to collect and analyze “clean” data that has no noise or errors. But real experimental data always contains measurement noise and ambiguity. Examine the figures below.

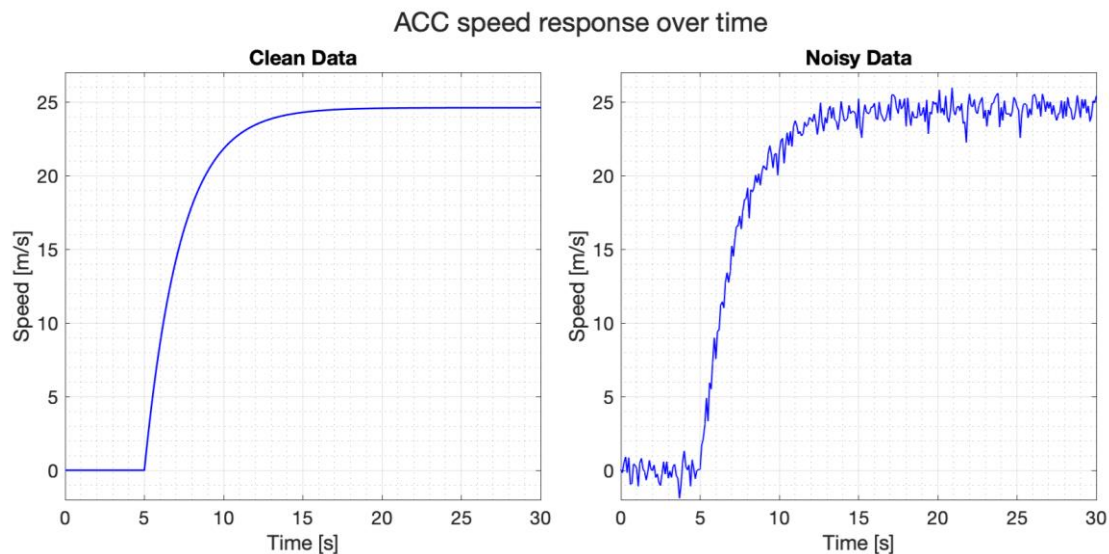


Figure 1. Compare clean data and noisy data side-by-side.

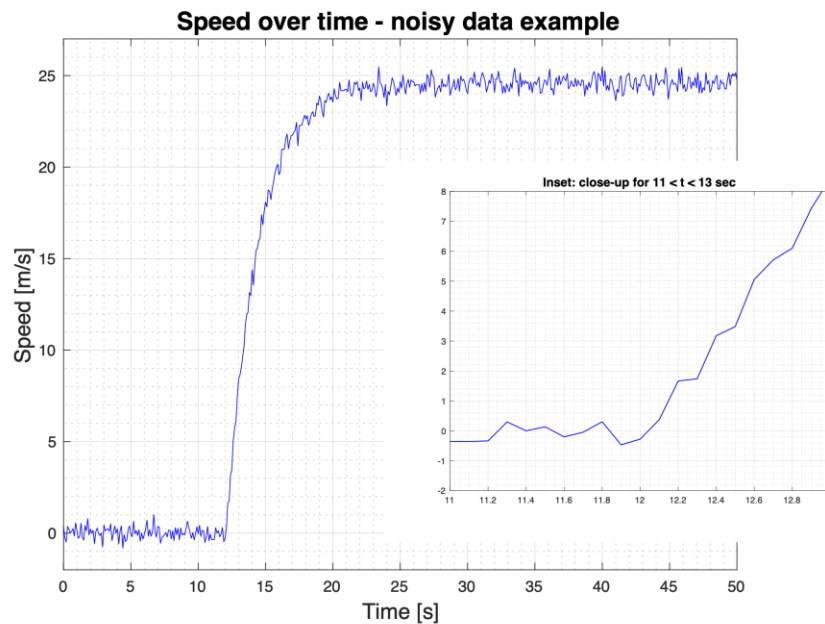


Figure 2. Example of noisy data with a close-up of the start time of the first-order response.

Experimental noise can come from many different sources, and it always makes parameter identification more challenging. For this part of the milestone, you will brainstorm and document coding approaches to identify first-order parameters from noisy data with errors. Before you focus on the parameters, consider the data itself. You can see that it is noisy and that it has errors.

Part 4a. Approaches to Managing Noise in Data

In Part 4a of the M1B Answer Sheet, brainstorm and record two approaches for managing the noise.

You may not be able to eliminate all the noise, but you should think of ways attempt to clean up the data as much as possible without altering the data patterns and trends. Your brainstorming may include words, flowcharts, or sketches, but should not include MATLAB code. Then answer the corresponding questions. You will need at least one in-text citation for each evidence-based justification of your approach with explicit references to MATLAB functions and coding techniques needed to translate your steps to operational code. Include any external sources, cited in APA 7th Edition style, in *Part 6*.

References on your M1B Answer Sheet.

Part 4b. Approaches to Managing Errors in Data

In Part 4b of the M1B Answer Sheet, brainstorm and record one approach for managing each of the three error types. You may not be able to eliminate all effects of the errors, but, as with the noise, you should think of ways to attempt to clean up the data as much as possible without altering the data patterns and trends. Again, your brainstorming may include words, flowcharts, or sketches, but should not include MATLAB code. Then answer the corresponding questions. You will need at least one in-text citation for each evidence-based justification of your approach with explicit references to MATLAB

functions and coding techniques needed to translate your steps to operational code. Include any external sources, cited in APA 7th Edition style, in *Part 6. References* on your M1B Answer Sheet.

Part 5: Brainstorm Approaches to Parameter Identification

Your next step is to develop plans to find the first-order parameters from noisy data; even if the noise and errors have been managed somewhat, you should anticipate some noise and error in your parameter identification. You may want to use the clean data model to help you develop ideas. Ask yourselves how you would identify parameters in clean data and then expand on that to accommodate the issues you see in noisy data.

In Part 5 of the M1B Answer Sheet, brainstorm and record the following approaches:

- Two approaches for identifying acceleration start time (Part 5a.)
- Two approaches for identifying the time constant (Part 5b.)
- One approach for identifying initial speed (Part 5c.)
- One approach for identifying final speed (Part 5c.)

All parameters must be identified in a fully automated way, without any user intervention. Your brainstorming may include words, flowcharts, or sketches, but should not include MATLAB code. Then answer the corresponding questions. You will need at least one in-text citation for each evidence-based justification of your approach with explicit references to MATLAB functions and coding techniques needed to translate your steps to operational code. Include any external sources, cited in APA 7th Edition style, in *Part 6. References* on your M1B Answer Sheet.

Submitting your Deliverables to Gradescope

Once you have completed each of the parts above, you will submit all of your deliverables to the associated Gradescope assignment as a team.

1. Save the answer sheet as a PDF named M1B_AnswerSheet_SSS_TT.pdf where SSS is your section number (e.g., 001 for section 001) and TT is your team number (e.g., 07 for team 7).
2. Select one person to submit all files for the team. They should log into Gradescope and submit all these files together to the M1B assignment:
 - a. M1B_AnswerSheet_SSS_TT.pdf
 - b. M1B_main_SSS_TT_login.m
 - c. M1B_sub2_SSS_TT_login.m
 - d. M1B_sub3_SSS_TT_login.m
 - e. M1B_sub4_SSS_TT_login.m
3. Select all team members for the group assignment. [\[Help Link\]](#).
 - a. Each team member should confirm that they are part of the submission. Everyone received an email when they were added. You will lose points if you do not include all teammates in the submission.
4. You will see “Autograder” information when you view your submission. Select “Code” in the upper right. That will show all your submission files. The autograder feature is not enabled for this project.
5. After submission, distribute the submitted files to all team members. Ensure all members of the team have copies of the submitted files.

It is important to note that if you need to resubmit anything for any reason, you must resubmit ALL files for the assignment. Gradescope will allow for multiple submissions up until the due date. The person who originally submitted should be the one to resubmit. If someone else resubmits, it can create issues where not everyone is tagged in the assignment and you will lose points.