SOLIDWORKS Motion Study Tutorial: Setup and Kinematic Analysis for SHER-3.0

Botao Zhao

August 11, 2025

Contents

1 Introduction

This guide is intended for readers who are new to **SOLIDWORKS Motion Study** and want a practical starting point for applying it to robotic system design. From my perspective, Motion Study is an extremely convenient tool for quickly validating a robot's design, performing preliminary kinematic checks, and gaining early insights into structural analysis without needing a full simulation package. Its workflow supports rapid iteration, allowing you to modify your design and immediately observe the effects on motion and performance.

Using the **SHER-3.0** robot arm as an example, this tutorial walks through the setup and execution of a kinematic analysis, helping you understand how to use Motion Study effectively for early-stage design validation. The CAD files and kinematic equations of SHER-3.0 are available at: **https://github.com/zhaob5/sher3-kinematics**

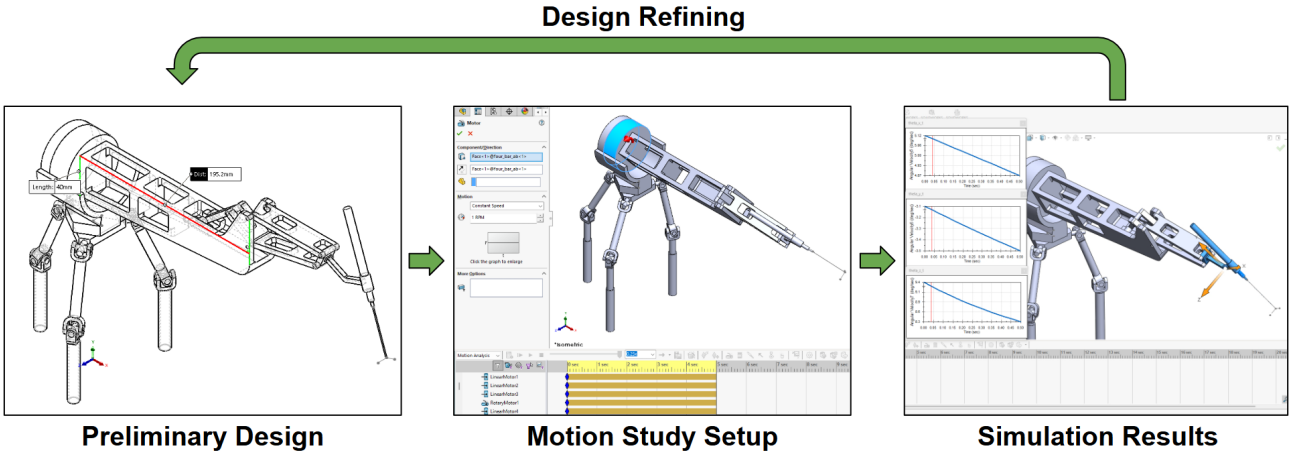

Figure 1: SolidWorks Motion Study Workflow

2 Setting Up and Running a Motion Study

To create a Motion Study, enable **SOLIDWORKS Motion** in **Tools** > **Add-ins**.

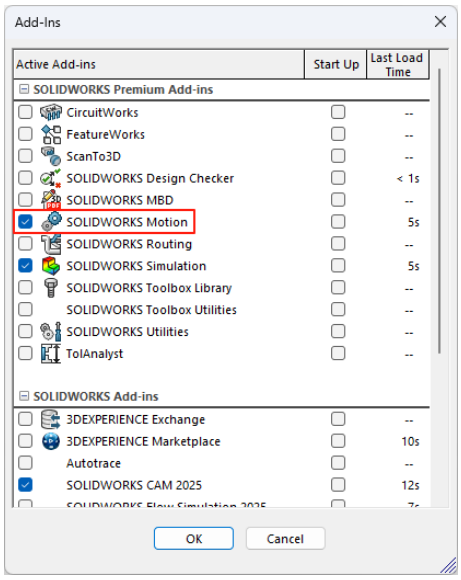

Figure 2: SOLIDWORKS Add-Ins Dialog

2.1 Prepare the Home Configuration

Begin by positioning your robot assembly in its home or zero configuration. This will serve as the starting point for your motion analysis. Ensure all mates and constraints are correctly defined so that the mechanism moves as intended.

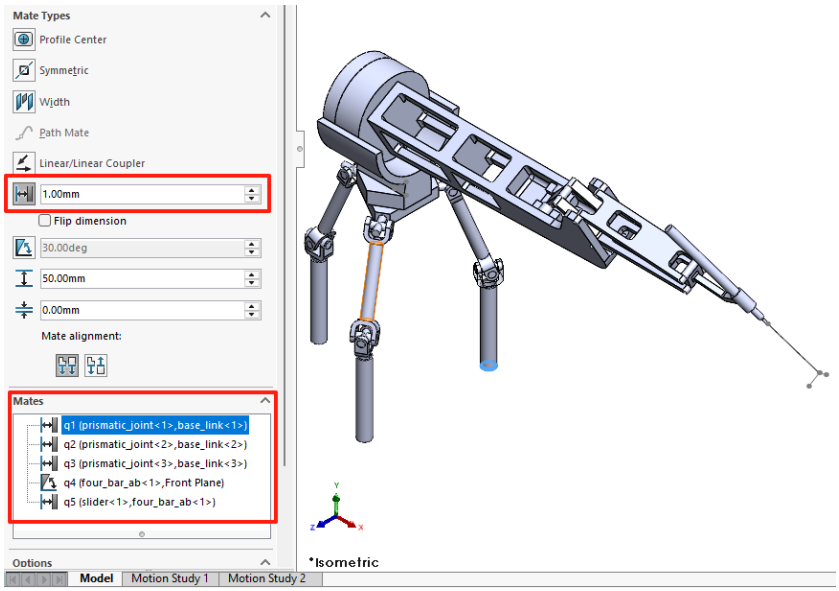

Figure 3: Home Configuration Setup in Assembly Model

2.2 Switch to Motion Study Mode

In the assembly environment, click **Motion Study** tab, then open the dropdown menu at the lower left of the screen and select **Motion Analysis**. This will bring up the Motion Study timeline and toolset, where you can define motion inputs, simulation parameters, and analysis outputs.

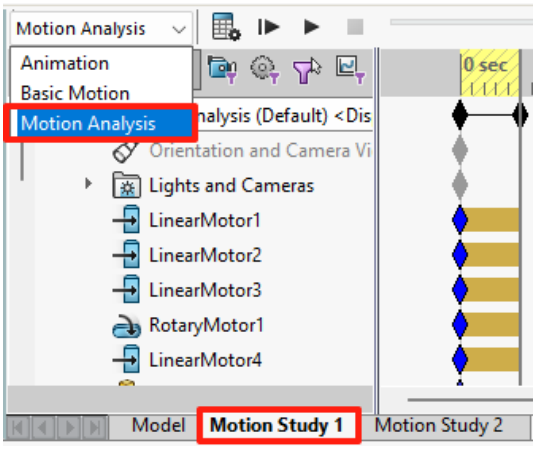

Figure 4: Select Motion Analysis Mode

2.3 Assign Motors and Motion Inputs

For each joint or actuator, assign the appropriate motor type (**rotary** or **linear**) and specify the desired speed. SOLIDWORKS allows you to control motion either with constant values or with functions over time, enabling more realistic simulation of joint trajectories.

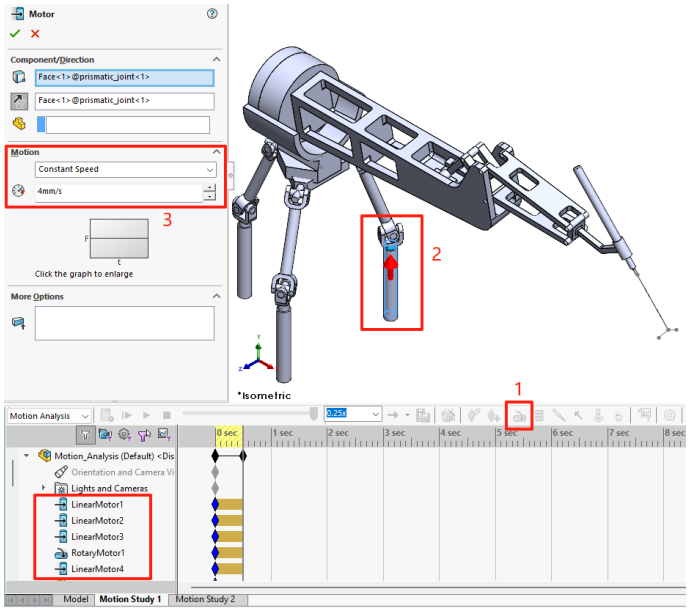

Figure 5: Motor Setup

2.4 Set the Simulation Time

Define the total duration of the motion study in the timeline settings. Adjusting this parameter controls how long the simulation runs and determines the resolution of your results.

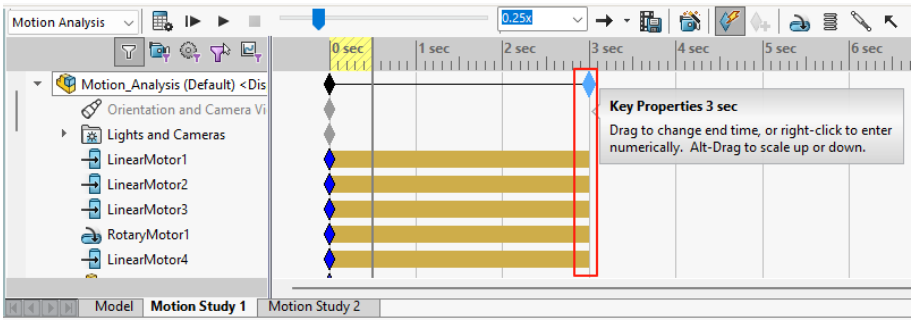

Figure 6: Simulation Time Setup

2.5 Run the Simulation

Once the setup is complete, run the simulation. Once the setup is complete, run the simulation. After it finishes, click the Results and Plots icon to generate motion data. To plot linear velocity, select a specific point on the part. To plot angular velocity, select a surface or feature that represents the rotating body. This ensures that SOLIDWORKS calculates the velocity data for the exact location or rotation you intend to analyze.

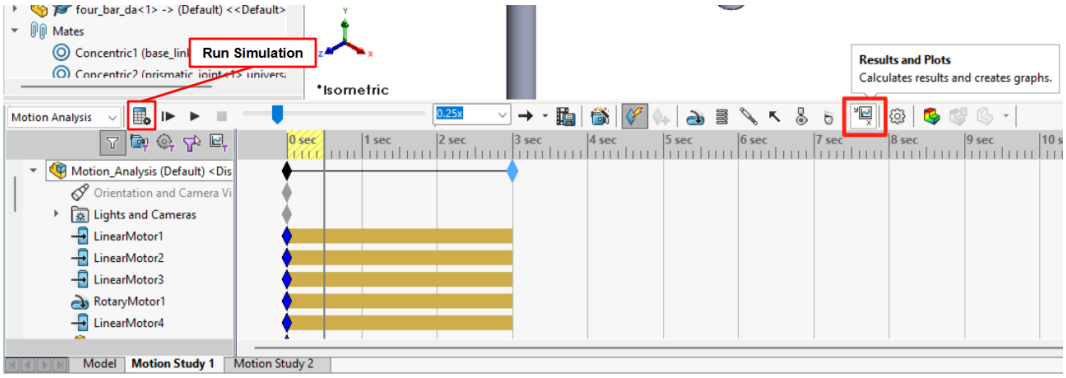

Figure 7: Run Simulation, Results and Plots Icons

3 Result Analysis

When choosing a reference frame, you may use the global frame defined in the assembly or a local reference frame created in the part file. Using a local frame is particularly useful for analyzing motion relative to a specific link in the robot arm.

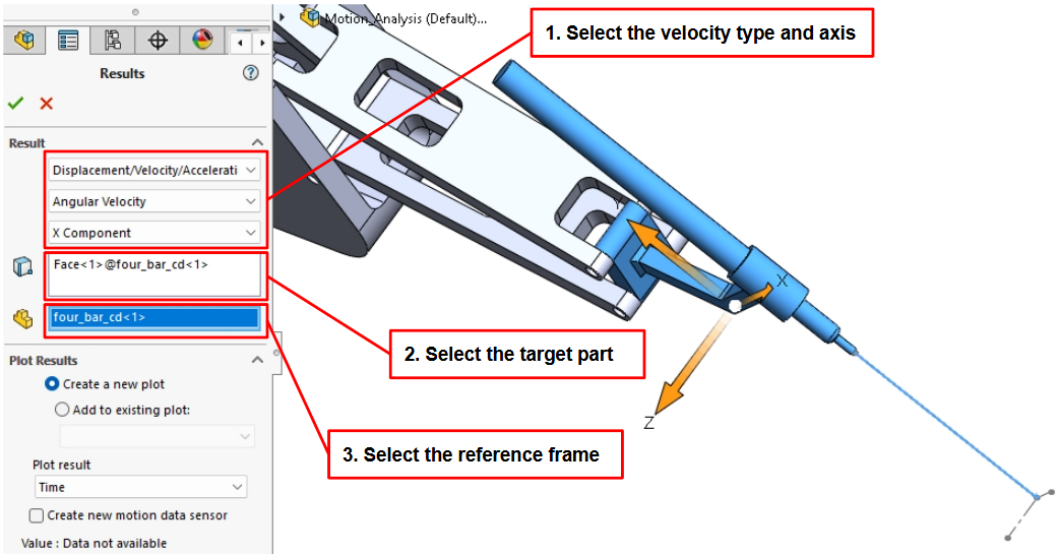

Figure 8: Result and Plot Setup Page

Since SOLIDWORKS Motion Study does not provide instantaneous velocity outputs directly at a specific configuration, you can use one of two approaches. First, you can export the simulation results to a .csv or similar spreadsheet file, then extract the velocity values corresponding to your desired time step. Alternatively, you can set the simulation's time to the desired instant (e.g., t = 0) and read the velocity values directly from the results plot at that moment.

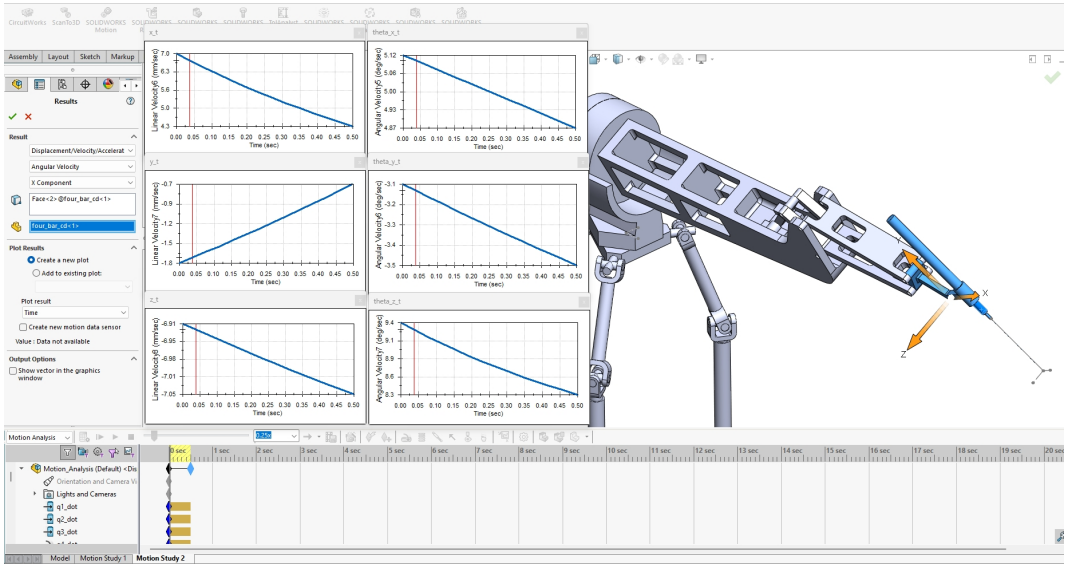

Figure 9: Linear and Angular Velocity Plots of SHER-3.0

4 Disclaimer

This guide is intended as a quick-start reference for setting up and running basic kinematic analyses in SOLIDWORKS Motion Study, using SHER-3.0 as an example. It is not a comprehensive training resource. If you are unfamiliar with SOLIDWORKS Motion Study or lack prior simulation experience, it is strongly recommended that you consult more detailed tutorials, official documentation, or formal training materials. The steps and examples provided here are based on my personal workflow and understanding, and may involve simplifications or assumptions that are not universally applicable. Readers should independently verify any results before applying them to critical design decisions or safety-related applications. If you spot any errors, have suggestions, or would like to discuss the topic further, feel free to reach out to me at: bzhao17@alumni.jh.edu.