

## Team 4 Dynamics II Plan

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### Material Selection

Our team has decided to use cardstock and cardboard for the main materials of fabrication. Each team member will either use cardboard or cardstock to test the dynamics of our system. In addition to these materials, one of the team members has access to a 3D printer. We will use PLA and a 3D printer to create professional parts for our prototype. Additionally, our team is using pen springs, three micro servo motors, a microcontroller, and glue.

### Parameters Modeled

Because our team has three members, we decided to split one parameter simulation per member. Andrei will work on actuator fitting, Feba will gather damping information, and Charlotte will collect material link and joint stiffness information. The tests executed for each of these parameter models will be explained below:

- **Actuator Fitting:** because the team is using a spring and motor to contract and expand the sarrus mechanisms, the team must first calculate the force/torque needed to contract the spring. This will be done with theoretical calculations through MATLAB code and physical testing with the use of a scale and ruler to determine force vs displacement. Once the torque required to contract the spring is calculated, a motor will be specced based on its max torque capabilities.
- **Joint Stiffness Calculations:** the team will execute a variety of different cantilever tests using both cardboard and cardstock to determine the superior material of the two. Each material will be clamped to a desk and weights will slowly be attached to the end of the material. The team will gather deflection information and calculate the overall stiffness of the materials using equations and data from the cantilever tests.
- **Damping Calculations:** to determine the damping of the sarrus mechanisms, video software was used to track the motion of the mechanism when a weight is dropped onto it. The video software will output an oscillating signal which will then be used to determine the damping coefficient of the sarrus mechanism.

### Prototyping

Because Andrei has a 3D printer, cardstock, cardboard, springs, glue, motors, and microcontrollers, he will be in charge of creating our team's prototype. The team's mechanical design will consist of three sarrus mechanisms placed on top of one another vertically. The sarrus mechanisms are made from cardstock material and the spring/support system is made from PLA printed parts.

### Individual Deliverables

- **Andrei:** actuator fitting, updating code, prototyping, compiling information to a report (Jupyter notebook and google doc will be used for this).
- **Feba:** damping calculations, adding model fitting routines
- **Charlotte:** material stiffness calculations and testing, filtering input data