Engineering Earthquake Resistant Buildings

Asynchronous Learning Document

CodeJoy

Strawbees®

do your :bit

A micro:bit digital challenge for the Global Goals

BACKGROUND INFORMATION

WHAT IS CODEJOY? CodeJoy is an online learning company offering synchronous sessions on coding & robotics, during which students can learn to code and control our robots in real time! Bring CodeJoy to your school, organization, or classroom for a personalized remote robotics session. **Contact Us.**

CODEJOY + MICRO:BIT: CodeJoy seeks to help inspire students' creativity and participation in the Do Your :Bit challenge by providing greater access to micro:bit through our online workshops and classes. Each 45 minute session involves an introduction to micro:bit & coding, introduction to the Do Your :Bit Challenge, interactive remote coding and robotics lesson, brainstorming and submission guidelines for Do Your :Bit Challenge, and Q&A. Learn more about Do Your :BIt and find more CodeJoy Do Your :Bit sessions **HERE**.

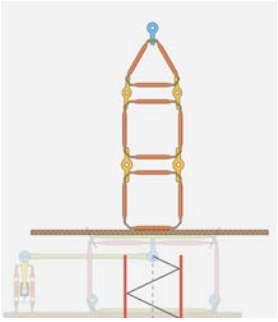
WHAT ARE STRAWBEES? Strawbees are a great building material for structural and mechanical projects. The Strawbees company also makes the Robotic Intention Kit for micro:bit, which allows you to control Strawbees creation by programming a micro:bit. Learn more **HERE.**

ABOUT THIS SESSION: Help the CodeJoy and Strawbees team design and test building structures that can withstand an earthquake. This earthquake will be simulated by a micro:bit-powered shake table made with the Strawbees Robotic Invention Kit as we explore UN Global Goal 13 - Climate Action.

RECORDING: This session took place on March 20, 2021, at 1:00pm EST. Watch the recording **HERE**.

ENGINEERING EARTHQUAKE RESISTANT BUILDINGS: HOW TO

STEP 1: Build a Shake Table and a Structure

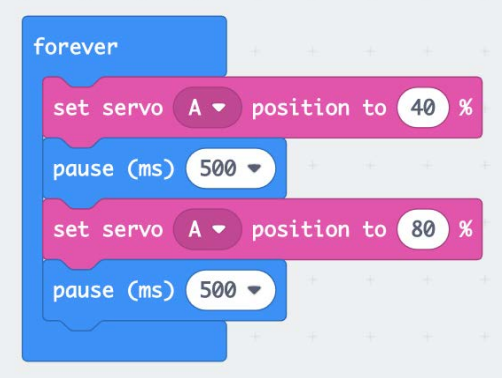


- **Make a Shake Table:** Once you have a Strawbees Robotic Invention Kit or similar, follow this tutorial to build your own Shake Table.
- **Build a Structure:** Build a structure, or a couple of structures you would like to test. We built a simple tower, and a second version with cross bracing, using wooden skewers and marshmallows.
- **Secure the Structure and Add Weight:** Make sure you have some tape to secure the structure to the shake table, and something with a bit of weight to place on top. This will allow you to see forces acting on the structure.

STEP 2: Program Your Motor to Test the Structure

- ***Your Creative Coding Goal:*** *Test the structure at different angles and speeds.*

- Open this example file.
  - Makecode Link for Students: https://makecode.microbit.org/_DMphm3fF2fiW
  - This works best on a laptop or Chromebook.
  - When you open the file, click the "Edit Code" button at the top to be able to change the code.



- Editing the code:
  - **Explore the motor ANGLES.** The angles control how far the motor moves. What happens when the DIFFERENCE between the angles is bigger or smaller? (Minimum angle = 0, Maximum angle = 120)
  - **Explore the PAUSE block values.** The pause blocks control how long the motor stays at each angle. What happens when this number is bigger or smaller? When the pause blocks match or don't match?
  - If you have a micro:bit and robotics kit, click the purple **"Download"** button at the bottom and see your code in action!

STEP 3: Collect Data

- Make note of your trials. Check out the table on the last page to help track your data.
- What other date could you track?

STEP 4: Share Your Data, Design a Solution

- Show your data to someone else! Tell them what you learned!
- Use your shake table to test other factors like:

    - Test the same structural design made from different materials. How do the materials compare?
    - Test the same structure at different angles but the same speed, or different speeds but the same angles. Which is most destructive?
- Use a micro:bit to simulate some other weather event, and gather data.

Remember: Big change starts with good data!

DO YOUR :BIT SUBMISSION

ABOUT

We want you to design a solution to a problem that affects you and your community. Use your imagination and be as creative as possible! Submissions are due by July 31, 2021, and you CAN submit more than one idea! Submit an idea by yourself or in a group of up to 3 students.

There will be two age categories for entry this year.

1. 8-14 year olds:
    - Submit an idea that solves a problem that works towards delivering the Global Goals and create a paper prototype to explain the idea, OR
    - Design and make a solution using the micro:bit to solve a problem that works towards delivering the Global Goals.
2. 15 - 18 year olds:
    - Design and make a solution using the micro:bit to solve a problem that works towards delivering the Global Goals.

What do I need to do?

To enter the challenge, you will need:

- to tell us about your solution - What have you created? Why have you created it? How it will it help your community or another community?
- a paper prototype showing how your idea will work. This should be a photograph of your plans. Perhaps draw your solution with notes describing its functionality.
- Or a .hex file of your prototype code
- if you so choose, you may also include a video or photos of your device in action.

For more details, take a look at the **full challenge terms and conditions.**

LEARN MORE & SUBMIT YOUR IDEAS HERE

Bring CodeJoy to your school, organization, or classroom for a personalized remote robotics session. **Contact Us.**

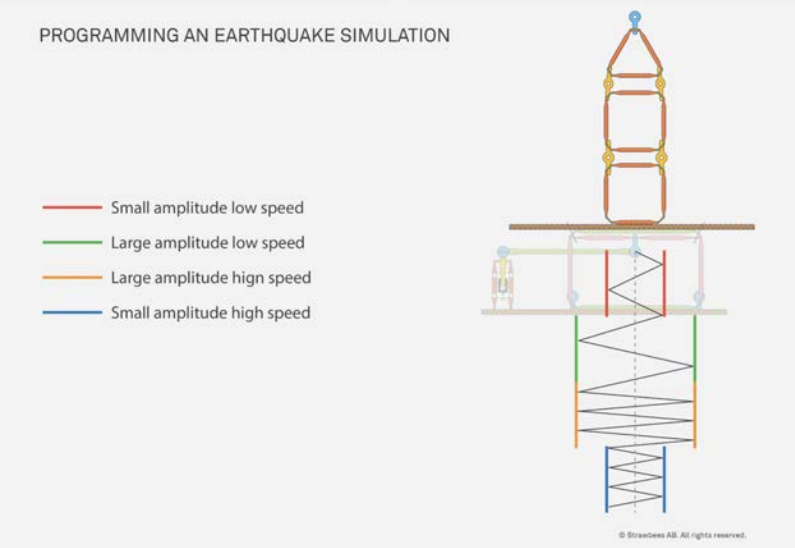
Thank you!

CodeJoy

SHAKE TABLE OBSERVATION SHEET

TERMS

- **Amplitude:** maximum movement from the equilibrium position (middle)
- **Frequency:** number of events per unit of time
- **Period:** time it takes to complete one oscillation



DATA COLLECTION

Trial #	**Difference between angles**	**Amplitude** (angle difference ÷ 2)	**Period** (sum of pause blocks, convert to seconds)	**Frequency** (1 ÷ period = ___ shakes per second, called Hertz)
1				
Outcome for structure 1:				
Outcome for structure 2:				
2				
Outcome for structure 1:				
Outcome for structure 2:				
3				
Outcome for structure 1:				
Outcome for structure 2:				
4				
Outcome for structure 1:				
Outcome for structure 2:				