Lab 14

Simulation

Simulation means using a physics engine inside the computer to test how a design behaves in real life — without actually building it. The governing physical equations are solved to obtain the resultant behaviour of the system under study. For example, you can simulate whether the football in a penalty shootout, can it go inside the envelope of the goal post? Engineers often do simulations to iteratively design before prototyping, which saves time and costs involved in testing.

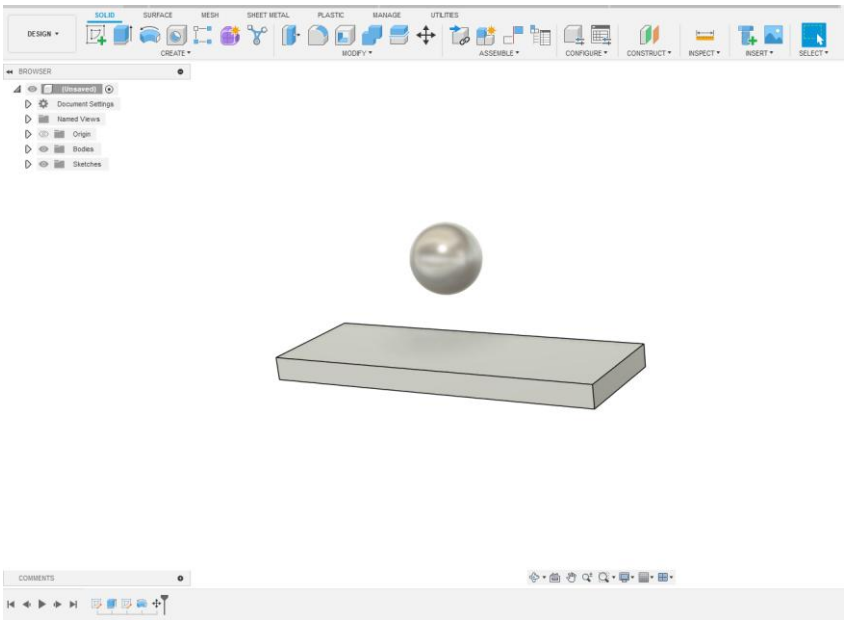
It works like this:

- You make a 3D model of a part or a machine.
- The software uses simple mechanics and physics laws (like force, motion, stress, and friction).
- It simulates how the part will move, bend, or break under real conditions.

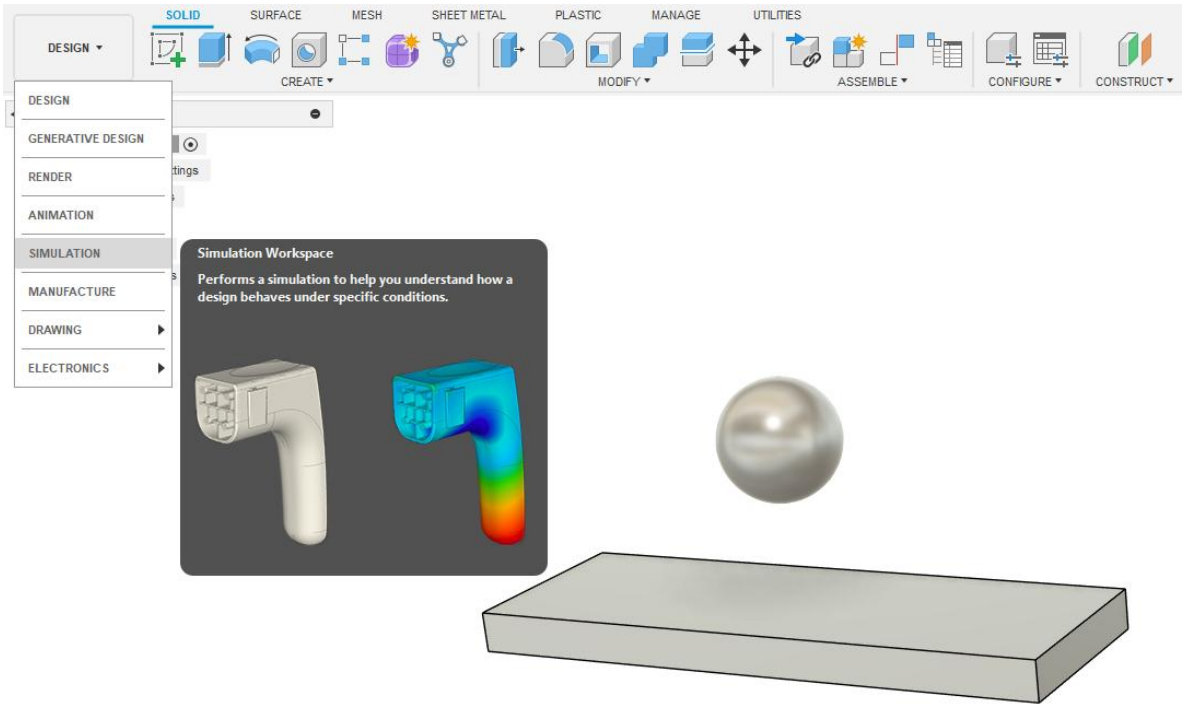
Q1. When Things Slip — Understanding the Impact of Falling Balls.

We have all seen balls or objects slipping from our hands and hitting the ground — a rubber ball, cricket ball, or metal ball. When this happens, forces act on both the ball and the surface it hits. Some materials bounce, some dent, and others break. But why does this happen? Let's find out using Autodesk Fusion Simulation.

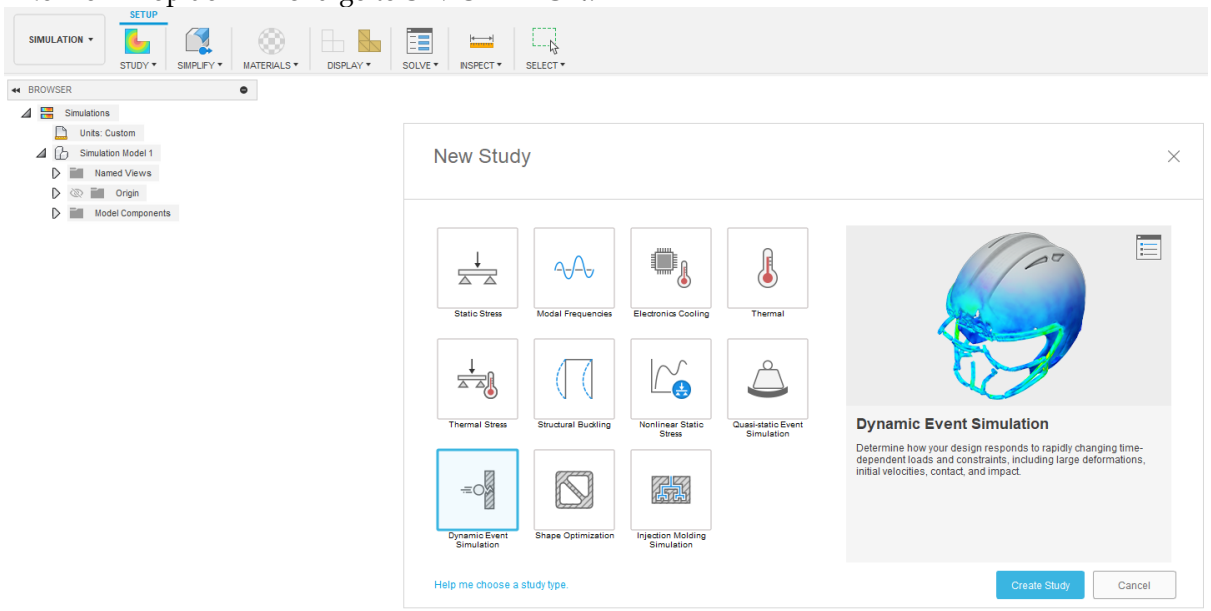
In this activity, you will explore how balls made of different materials (like rubber, aluminium, steel, or plastic – take anyone) behave when they fall and hit bases made of different materials (like wood, steel, or concrete – take anyone). The goal is to understand how the properties of materials affect stress and deformation when an impact occurs.



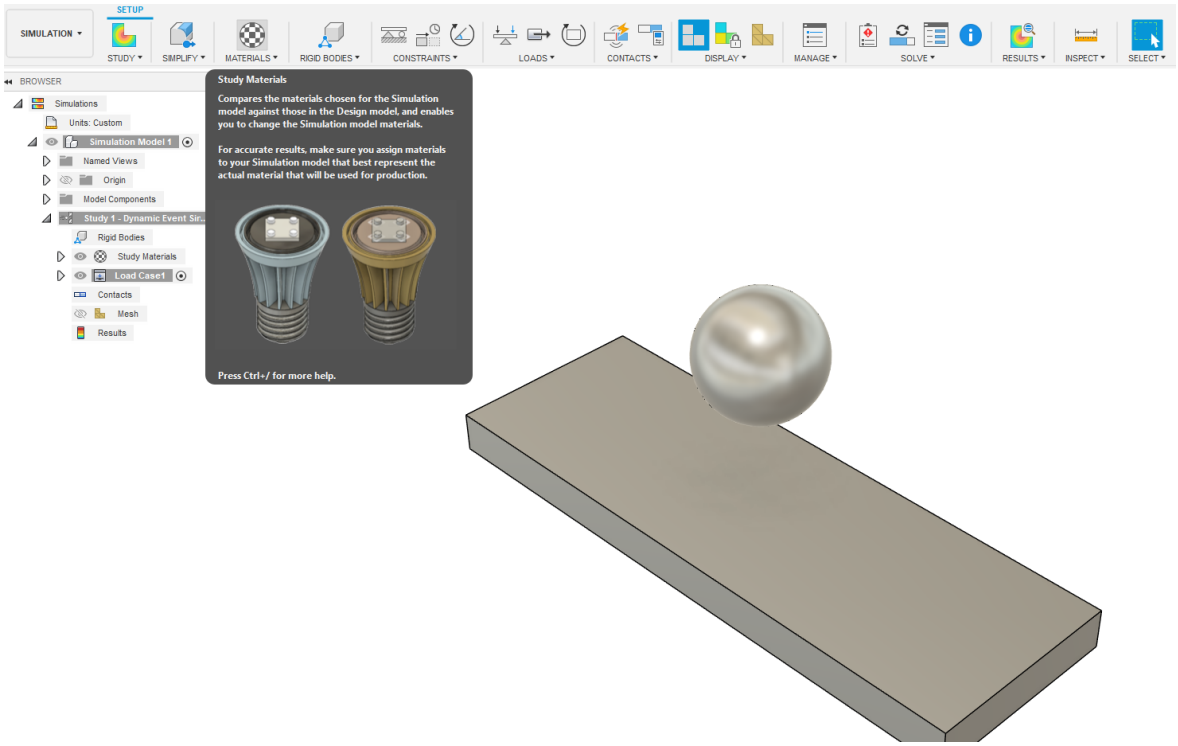
Design a simple ball and base using basic shapes (a sphere and a block).
(using real-life dimensions)



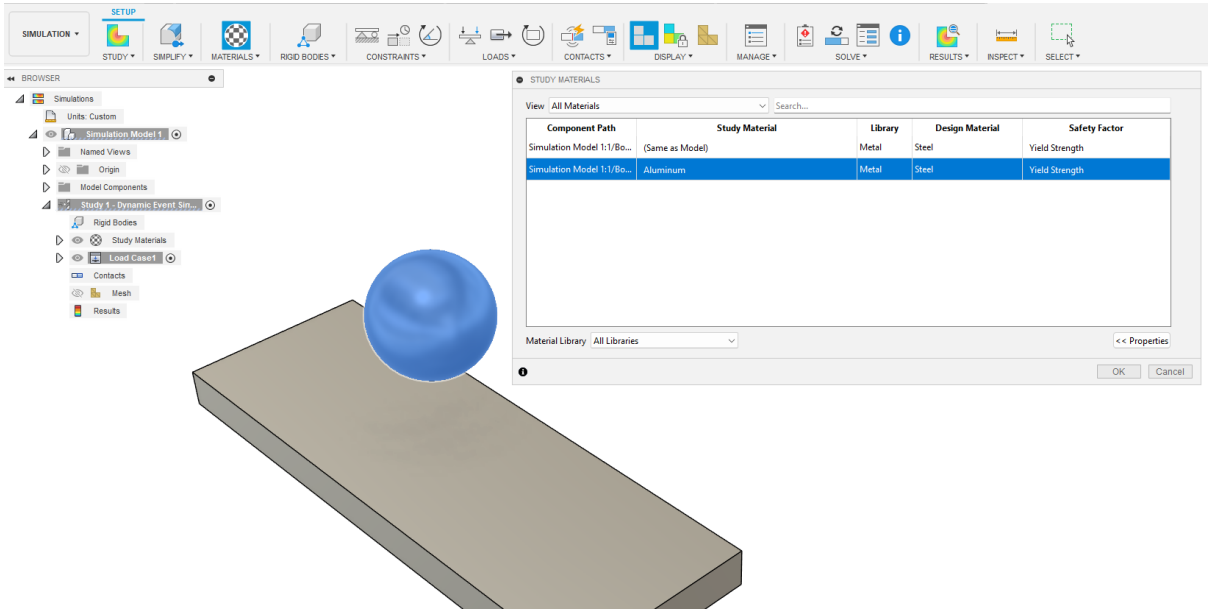
Now on Drop down menu go to **SIMULATION**.



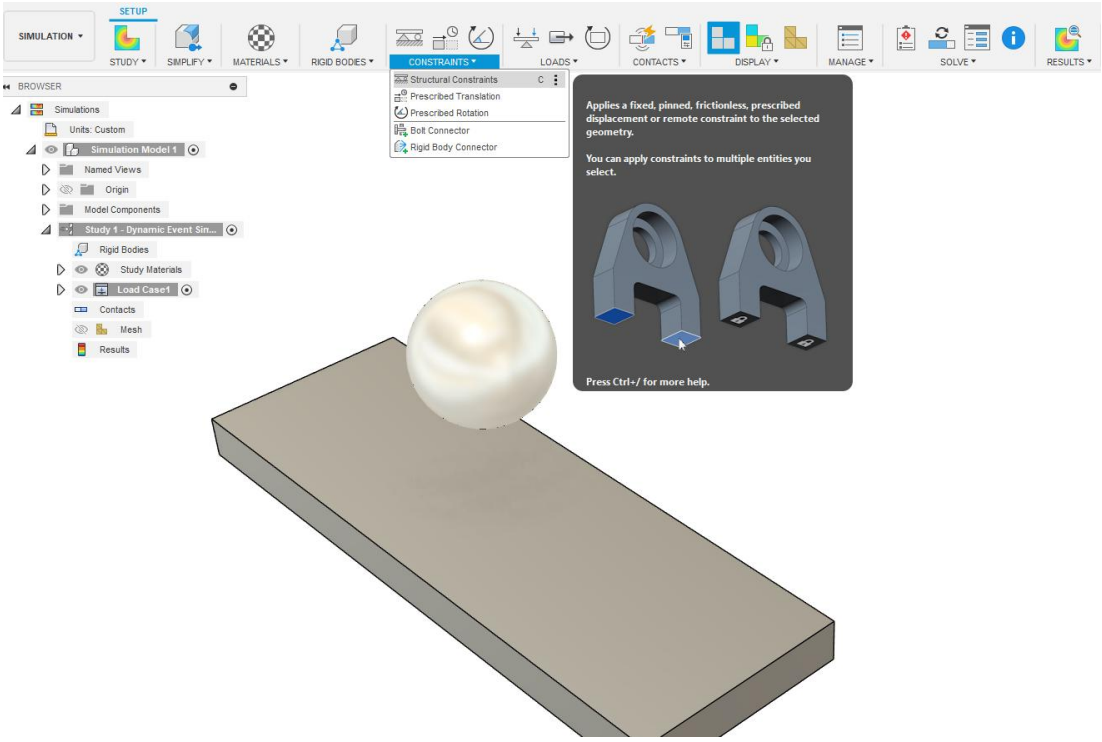
Select **Dynamic event simulation**



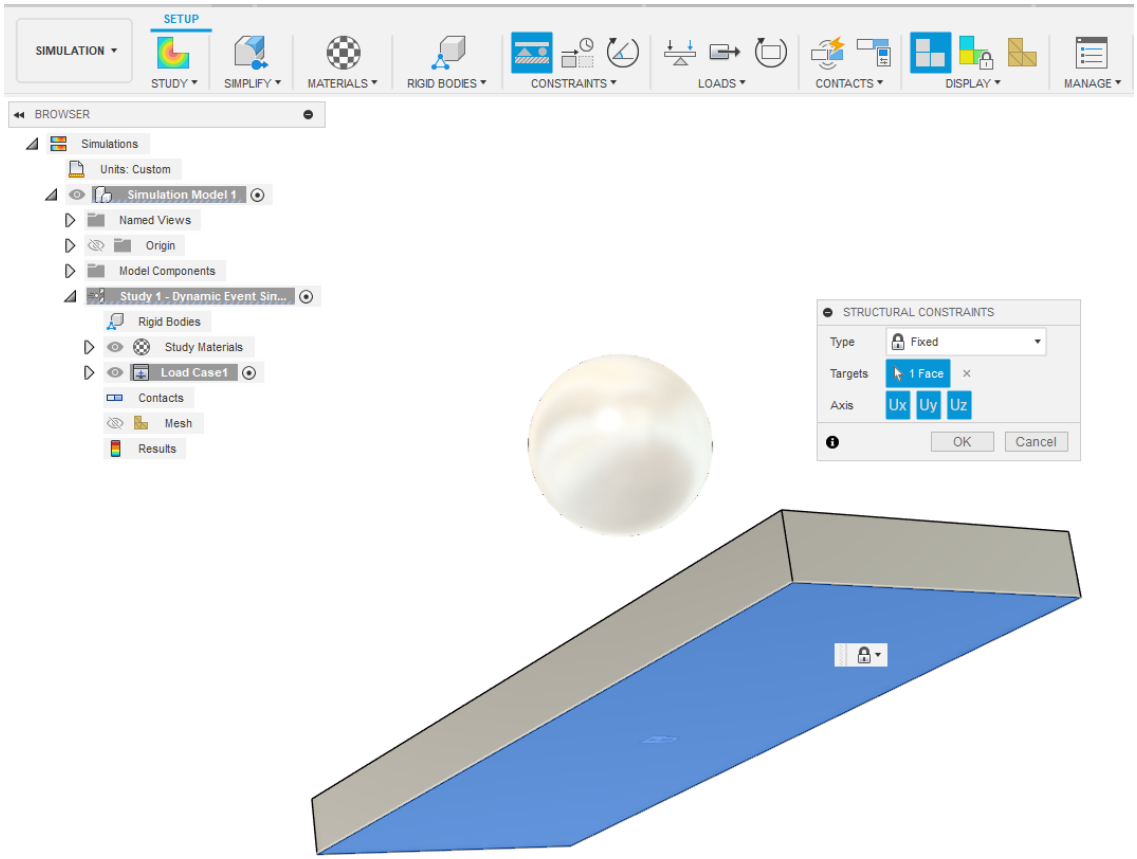
Select the **Material**



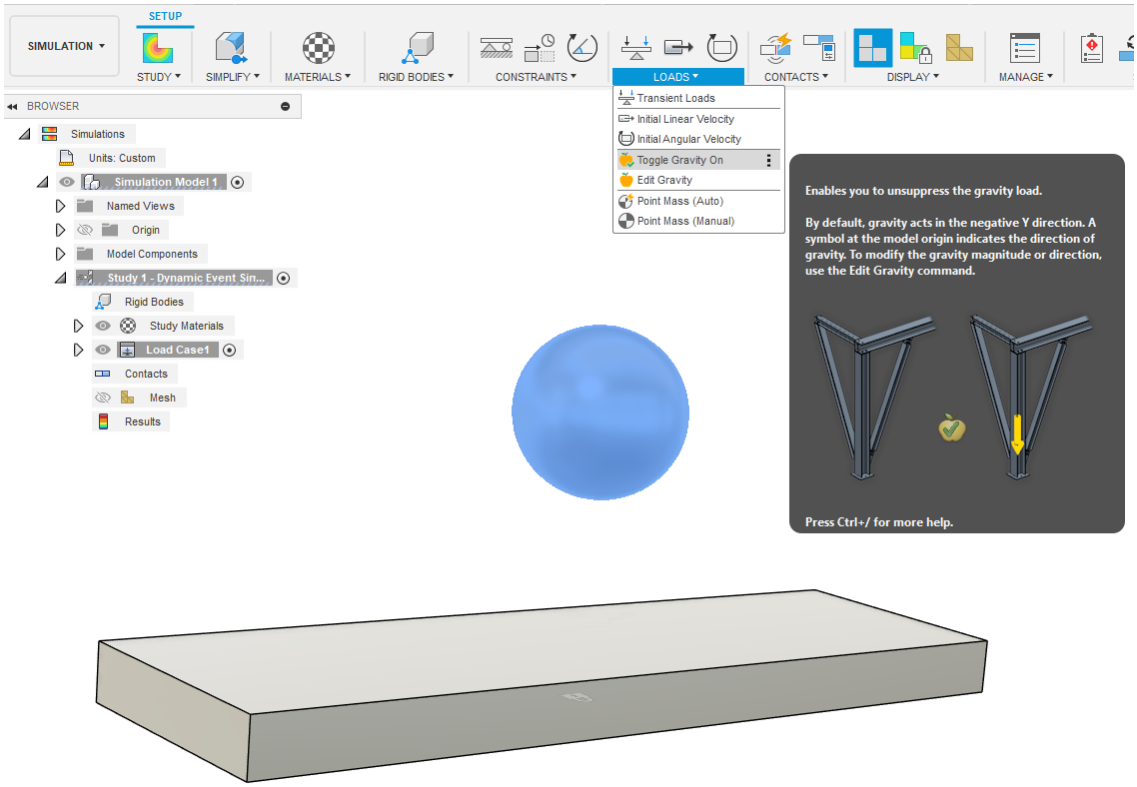
From Fusion's material library, assign the correct materials to each ball and base. Notice the differences in properties such as density, stiffness, and elasticity.



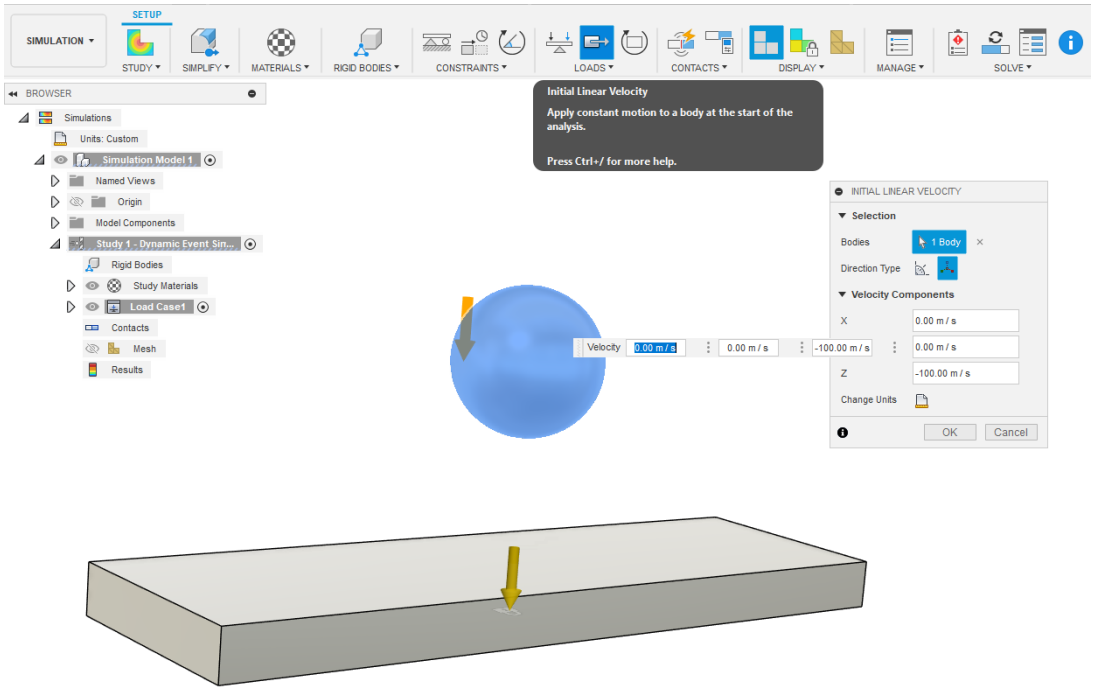
Apply **Constraints**



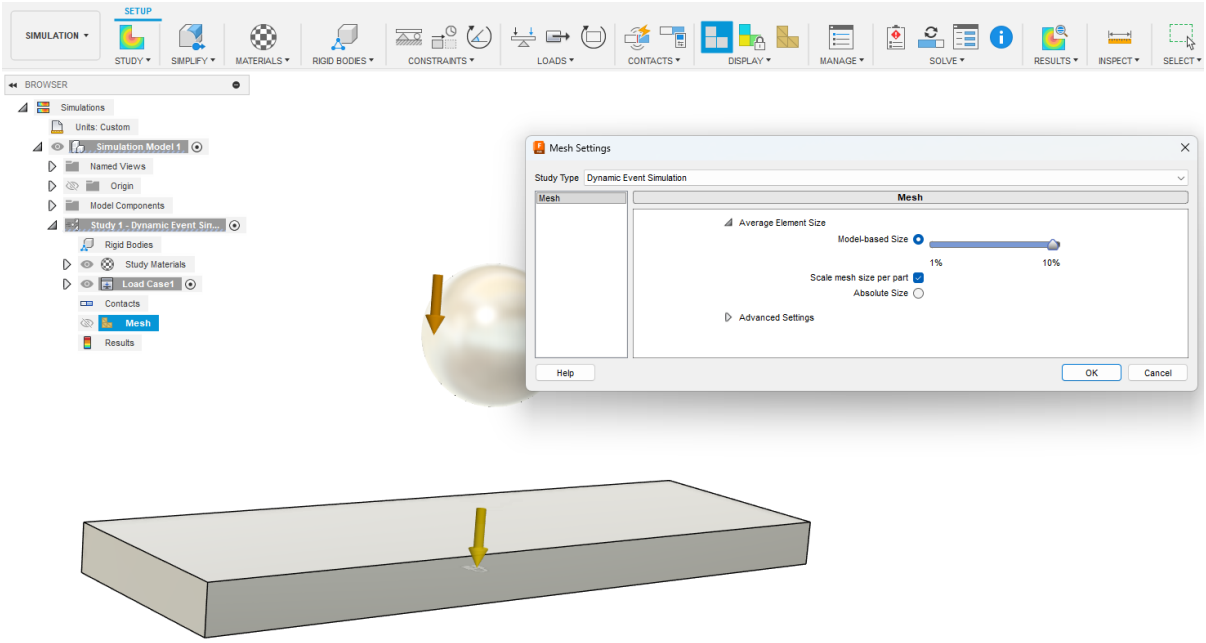
Fixed the base to Ground



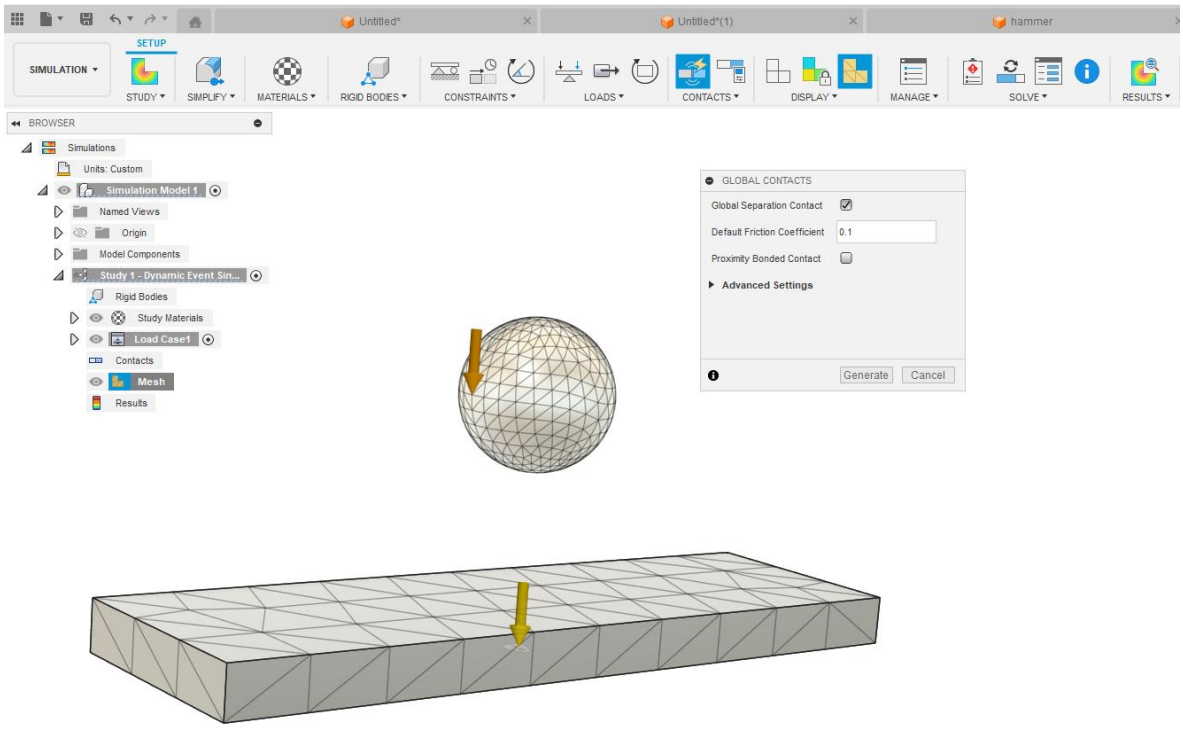
Apply gravity so it drops and hits the base.



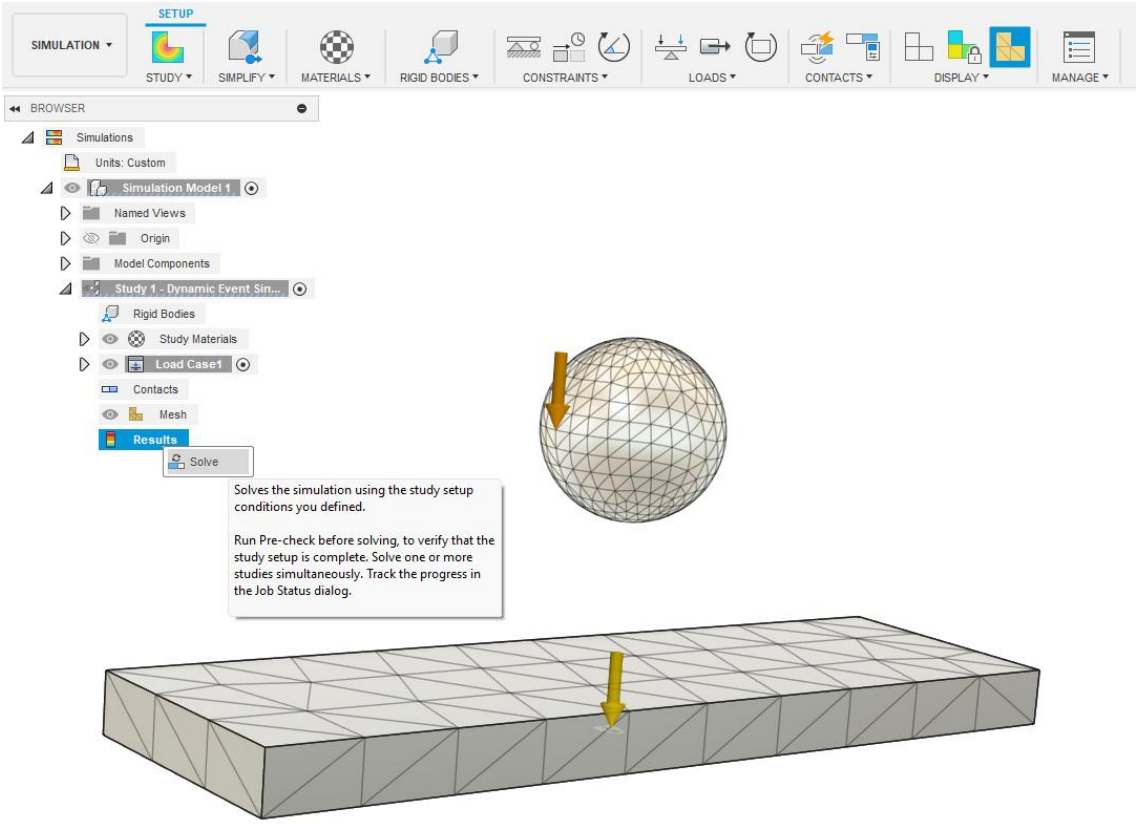
Give the ball an **Initial speed**



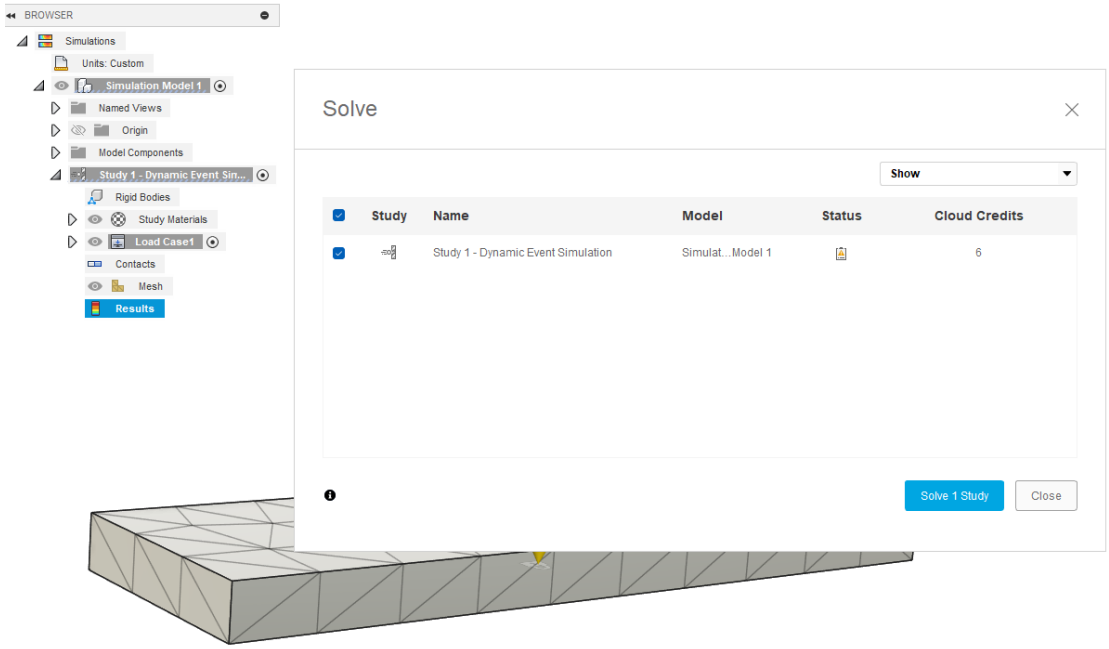
Mesh the Model



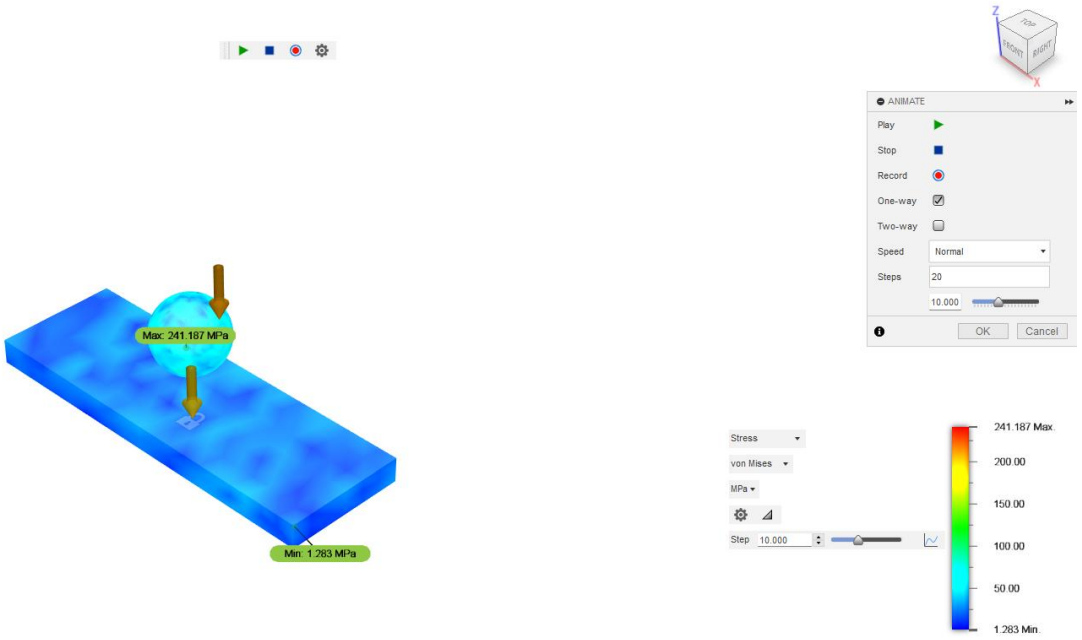
Define how the ball and base touch each other (contact setup)



Solve the result



Start the study



RESULTS

Outcome:

After completing this simulation, you will understand how materials respond when they collide. You will see that softer materials (like rubber) deform more and absorb energy, while harder materials (like steel) deform less but transfer more stress. This simple virtual experiment helps you connect everyday experiences with engineering mechanics in a fun and visual way.

Note: Upload animation of *stress distribution and deformation of* Plate and Ball on moodle.

Q2. Analyse & Model a Hammer-Strike Scenario.

In the video (https://www.youtube.com/watch?v=YicUPxXpw0c), a hammer striking a steel plate is simulated in Autodesk Fusion 360.
Now your task: Create a 3D model using real-life dimensions of a hammer and a platform (steel plate) and simulate the impact.

Steps to follow:

- Measure or look up typical real-life dimensions for a hammer (handle length, head size) and the steel plate/platform thickness and size.
- In Fusion 360, model the hammer (head + handle) and the steel plate using those dimensions.
- Assign correct material properties: e.g., steel for the hammer head, wood or steel for the handle, steel for the plate.
- Set up contact between hammer head and steel plate.
- Apply motion or an initial velocity to the hammer striking the plate (or drop scenario).
- Run the simulation to observe *stress distribution and deformation on both hammer and plate*.

- Record your observations: Which part sees the highest stress? Does the plate deform visibly? How does the hammer respond?

Note: Upload animation of *stress distribution and deformation of* Hammer and Plate on moodle.

*Image For Reference