Report TP03: Pouring Coffee Into a Cup

1. Introduction

This report describes the creation of a liquid simulation in **Blender** using the **Mantaflow Fluid System**. The objective of the project was to simulate **coffee being poured into a cup**, using:

- A **sphere** as the *liquid flow* (inflow source)
- A **cube** as the *domain*
- A **cup** as the *effector/obstacle*

The simulation mimics a realistic fluid behavior, demonstrating the interaction between flowing liquid and a rigid container.

2. Project Setup

2.1 Scene Preparation

1. Opened a new Blender file and deleted default objects not needed.
2. Imported or modeled a **cup** object that would act as the receiver of the fluid.
3. Placed the cup inside a large enough **cube domain**.
4. Added a **UV Sphere** above the cup to serve as the *liquid inflow emitter*.

3. Simulation Components

3.1 Domain (Cube)

- The cube was scaled to fully contain:
  - The cup
  - The falling liquid
- **Physics Type:** Fluid → *Domain*
- **Domain Type:** Liquid
- **Resolution Divisions:** Adjusted for quality (120)
- **Cache Type:** All.
- **Bake Settings:** Liquid + Mesh enabled to generate a realistic liquid surface

The domain is responsible for computing the entire fluid simulation.

3.2 Liquid Flow (Sphere)

- **Physics Type:** Fluid → *Flow*
- **Flow Type:** Liquid
- **Flow Behavior:** Inflow
- **Flow Rate:** Tuned to create a controlled stream of “coffee”
- The sphere continuously emits fluid as long as the simulation runs.

To make the fluid appear like coffee, a **dark red material** was applied.

3.3 Cup (Effector / Obstacle)

- **Physics Type:** Fluid → *Effector*
- **Effector Type:** Collision
- **Surface Thickness:** Adjusted for accurate collision detection
- The cup acts as a rigid object blocking and collecting the fluid.

The mesh was checked for proper normals to ensure correct fluid interaction.

4. Simulation Process

4.1 Positioning

- The sphere was placed above the cup opening.
- The cup was centered inside the domain.
- The domain boundaries were kept well away from the edges to avoid simulation artifacts.

4.2 Baking the Simulation

Steps performed:

1. Set domain resolution.
2. Enabled “Mesh” to generate a fluid surface.
3. Defined cache folder and selected a frame range suitable for the pour.
4. Baked the **Liquid** simulation.
5. Baked the **Mesh** for final fluid geometry.

5. Materials and Rendering

5.1 Coffee Material

- Principled BSDF shader
- Base Color: Dark red
- Transmission: Increased for translucency
- Roughness: Adjusted for realism

5.2 Cup Material

- White ceramic material created using Principled BSDF
- Slight roughness for realistic surface

5.3 Lighting & Rendering

- An HDRI or area lights added to create reflections in the liquid.
- Render engine: Cycles (preferred for realistic liquids)
- Samples: Optimized depending on scene complexity

6. Results and Observations

- The liquid flows naturally from the sphere into the cup.
- Collision with the cup is accurately detected thanks to the effector settings.
- Adjusting inflow rate and domain resolution significantly influenced the realism.
- The final render successfully represents a **coffee-pouring animation** with smooth and believable motion.