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Review of *Towards Animating Virtual Humans in Flooded Environments*

**Summary**

*Towards Animating Virtual Humans in Flooded Environments* is a research paper written by 4 students from the Pontifical Catholic University of Rio Grande do Sul in Brazil on the context of the MIG (Motion in Games) 2020 virtual event. As mentioned in the title, it tackles the concept of creating a realistic simulation of human movement and behavior within flooded environments, mostly for games. In fact, the simulation in question simulates “agents” or human beings walking on different types of environment and attempts to recreate realistic behaviors. For instance, walking normally, walking with an effort and getting dragged by a fluid are all behaviors expected out of it. Their main contribution is achieving this simulation by combining 2 physics simulation model: BioCrowds for human motion and collision detection, and SPlisHSPlasH for implementing smooth particle hydrodynamics solvers.

**Strengths and Weaknesses**

The authors’ claims come from applied equations from the 2 models used for their simulation: BioCrowds and SPlisHSPlasH, which returns the mass and the velocity of both the fluid particles and the human beings (or agents). They also return the resulting motion velocity vector of both objects in question. With those parameters, both models can be combined to calculate the velocities at time t + 1 by using Newton’s law of momentum conservation. In fact, the simulation at its fundamental level, is based off inelastic collisions between a fluid particle and an agent. From the formula that returns the agent’s new velocity, they introduced a new variable parameter τ that affects the fluid particle’s momenta and its mass. Theoretically, if that variable is equal to 0, the fluid has no effect on the agents’ velocity vector, whereas if it is equal to 1, the fluid drags away the agents, completely affecting their velocity vector. The experiments supposedly serve to prove this claim. Overall, the authors successfully substantiated their claim by performing enough thorough experiments. In fact, with 50 agents, they managed to visually demonstrate the expected behaviors with different τ values and different fluid velocities after 12 different tries.

However, there is a limitation that may hinder their experimentation results: the number of agents in the simulation. In fact, tests were only conducted for roughly 50 agents, but there aren’t any results for a higher number of agents, which can drastically change the overall result evaluation. There isn’t any confirmation if the number can affect the claim itself at hundreds, thousands or near infinity. Moreover, another experiment has been conducted with a single obstacle to show that a fixed object could create a safe zone for agents who can be unaffected by the fluid, but it isn’t thorough enough since it hasn’t been tested with different kinds of obstacles (different length or size).