RESEARCH INTO THE SIMULATION OF SHOCK WAVES

System Evaluation

Authors:
Michael Jones, Liam Ireland, Tomasz Mackow

Requirements

See below the requirements as set out in the “System Requirements” document.

Identifier Code	Requirement	Requirement Met
SR1	To be able to simulate movement of shockwaves in an environment.	Yes
SR2	To visualise the movement of shockwaves in real time.	Yes
SR3	The shockwave simulation must be realistic.	Partial
SR4	The simulation must be as efficient as possible within the technical constraints.	Yes
SR5	The user must be able to dynamically adjust the rate of time.	Yes
SR6	The user must be able to create their own scene and place the origin of the shockwave.	Partial
SR7	The system must simulate the effects of the shockwave on the surrounding environment.	Partial
SR8	The simulation must be in 3D.	Yes

Additional Notes

SR3, SR7

The particles model could not simulate complex wave properties such as diffraction in real time. The forces exerted on objects do not appear to be realistic or consistent due to unresolved issues internal to the system. The magnitude of the forces varies dependant on the timescale of the simulation. Due to our hardware limitations, there is a maximum number of particles that can be simulated at one time. The accuracy of the simulation is dependant on the number of particles and the complexity of the environment. For this reason, with current consumer hardware, the simulation is not sufficiently accurate.

Due to the limited timescale of the project, assets and the environment did not have the desired behaviour to be a realistic simulation, such as destructible objects and material properties such as shock wave absorption.

SR6

The user is not able to create their own environment. Due to the limited time frame of the project, certain requirements were prioritised over other. For example, the user being able to

choose the location of the shock wave origin was considered more important than being able to create their own scene.

Technical Requirements

See below the technical requirements as set out in the “System Requirements” document.

Identifier Code	Requirement	Requirement Met
TR1	The system must run on Windows as a minimum.	Yes
TR2	The system must be written in c#.	Yes
TR3	The system must be built using Unity.	Yes
TR4	The system will run at the speed of 25 frames per second on a consumer-grade Intel CPU.	Yes*

* Frame-rate is dependant on the accuracy parameter of the system. The system runs at 25FPS or better on consumer-grade hardware with default input parameters.

Conclusion

The system meets all of the basic requirements at least partially. However, the system does not fully meet the requirements due to a number of outstanding issues with the shock wave simulation. As a result the system is not suitable for use in third-party applications in its current state.

The system works well within the technical constraints as defined by the technical requirements list, and exceeds the frames-per-second requirements in most cases.