A Framework for Interactive Simulation

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1 Introduction

Creating a large-scale simulator for interactive applications involves several different research areas, such as proximity detection, collision detection, dynamics solver, integration, etc. There are a large number of techniques available for each one of the specific areas, but very little research on how to combine algorithms into a general simulator, handling more than one specific task. Furthermore, there is also a need to combine several different simulation techniques in the same virtual environment.

2 Background

Meqon Research AB, founded 2002 from a diploma work at NVIS, Campus Norrköping, Linköpings Universitet, develop an SDK for interactive simulation targeted at both industrial simulation and interactive entertainment. The SDK started as a rigid body simulator but has now evolved into a general framework for any type of interactive simulation. The common bits and pieces of interactive simulation has been generalized and placed in a framework, so that new simulation techniques can be added very easily.

3 Framework

The framework relies on an interaction model, which is used to model interactions between various types of entities in a simulation. Interaction may be anything from collision detection and hinge joints to behavioral animation or interacting smoke. The interaction model is used to model pair-wise interaction between two types of entities. Interactions are implemented as classes in C++, making it easy to inherit existing interactions and create new ones.

The framework is used today primarily for rigid body simulation, but it has also been used for particle systems (Figure 1), cloth, hoses, vehicle dynamics and behavioral animation. Current projects in Meqon include simulation of deformable objects, water surfaces (Figure 2) and the human body.

During the presentation we will discuss the common parts of large-scale interactive simulations, the interaction model and how it can be used to combine several simulation techniques in the same virtual environment. Examples will be given on how the framework is used in the SDK. Brief knowledge on interactive virtual environments, computer graphics and different simulation techniques in the audience is expected.
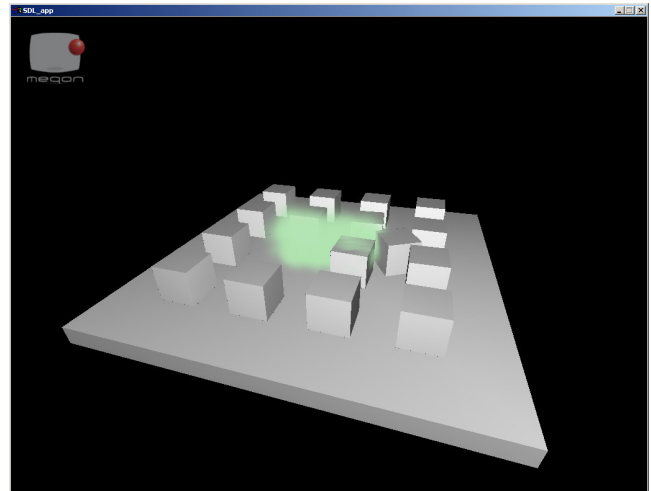

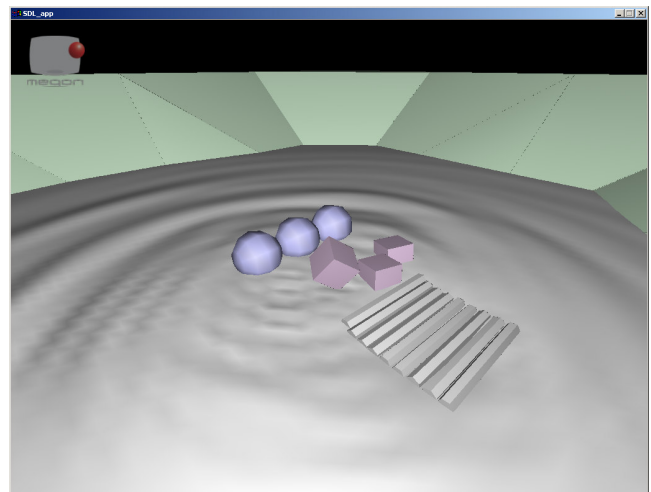Figure 1. A particle system interacting with rigid bodies.

Figure 2. Rigid bodies interacting with a liquid surface.