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Literature review -3

Primary paper: Simulation of Underwater Excavation Using Dredging Procedures

@ARTICLE{8336834,
author={P. Kouřil and F. Liarokapis},
journal={IEEE Computer Graphics and Applications},
title={Simulation of Underwater Excavation Using Dredging Procedures},
year={2018},
volume={38},
number={2},
pages={103-111},
keywords={Atmospheric modeling;Computational modeling;Real-time systems;Solid modeling;Underwater tracking;Visualization;computer graphics;fluid dynamics;material modeling;sand simulation;underwater excavation;virtual reality},
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month={Mar},}

Secondary Paper: Virtual sandbox

@INPROCEEDINGS{1238267,
author={K. Onoue and T. Nishita},
booktitle={11th Pacific Conference onComputer Graphics and Applications, 2003. Proceedings.},
title={Virtual sandbox},
year={2003},
volume={},
number={},
pages={252-259},
keywords={antialiasing;rendering (computer graphics);concave polyhedron;ground surface deformation;interactive frame rate;texture sliding technique;virtual reality system;Application software;Computer graphics;Computer performance;Deformable models;Object detection;Shape;Sheet materials;Soil;Virtual reality},

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I choose primary paper as Simulation of Underwater Excavation Using Dredging Procedures and secondary paper as Virtual sandbox.

Secondary paper explanation:

I choose this paper because I am very much interested in virtual reality concept which evolved in recent years. I believe this is the biggest revolution in the computer graphics stream. In this paper, they tried to implement a deformation algorithm in which A ground surface composed of a granular material can be deformed when it contacts with an object.

The algorithm is divided into three categories:

1. detection of the collision between an object and the ground surface
2. displacement of the granular material
3. erosion of the material at steep slopes

The basic idea of the paper is to implement algorithm which make the gamers/users of the virtual reality to experience the transformation or deformation of the sand material beneath at sea when an object is in contact with it. For example, users can interactively drag a bucket on the sand, scoop it up in the bucket, or drop it. This paper mainly focuses on the implementation of the deformation algorithm. In this algorithm approach, the volume of the granular material is divided into vertical columns which is defined as the height field. The HS Map in the cross section of an object shows the division of object into columns and its height is estimated in the cross section. This paper mainly focuses on polygon objects including the polyhedron and the ground material is defined as height field as stated above. Also, this algorithm mainly focuses on the HS- map which is two-dimensional array of Height Spans. Each height span represents the span of the object at each grid point. This HS map is mainly used to efficiently calculate the motion of the granular object at each point.

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In the later part of paper, they discussed different parameter to be considered in calculating the deformation of the ground surface. The deformation of the ground surface is calculated sequence of steps i.e.

Collision detection: The detection of a collision between an object and the ground is achieved using the HS Map.

Displacement of granular material: The granular material in contact with the object is forced to the surrounding columns.

Erosion: The surface is made smooth by moving granular material from high to low columns.

In the following part of the paper, each sequence point is explained in brief. In collision detection with objects and the ground surface it will be necessary to find out where and what depth the object penetrates. It can be done only through the HS map, where the height of each column in the region is compared with the height of the bottom of the object and through the intersection test is carried out between the bounding box of the object and that of the ground. And in case of Displacement of granular material, the material of a column with object is displaced to its neighboring columns. Here it mainly focuses on the motion of objects. The motion of the objects is divided into two types: 1. fall 2. Drag. Different algorithms such as Sumner's displacement is used for object falling and for object dragging the displacement formula are used to calculate the objects movement. After the Displacement step, here comes the Erosion step, in which steep slopes are detected and these slopes are decreased b collapsing the columns by moving the granular materials from the higher columns to lower columns. It also uses the Sumner's Method to examine the slope between each pair of the adjacent columns and to calculate the erosion step efficiently. The author explains different steps to calculate the erosion on objects such as height span calculation, comparison of higher granular materials to the height spans, volume of the particles. In the rendering of ground surface method, the height field is rendered as a mesh which is generated by connecting the granular material of each height span.

There is a tradeoff in the proposed algorithm. To overcome the tradeoff, they proposed anti-aliasing technique. This technique uses virtual spans instead of height spans to reduce the aliasing at boundaries. With this anti-aliasing technique, a reasonable image quality of the polygon is achieved. In the future work description, they described on methods if objects move relatively slowly or fast they need to incorporate dynamic effects such as spattering sand and currently the motion of object

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is not affected by the ground but if there would be any affection, then they would make automatic scenes to show the affection.

Primary paper: Simulation of Underwater Excavation Using Dredging Procedures.

In the previous paper- “virtual sandbox”, It explains the various techniques of transformation or deformation of the sand material beneath at sea when an object performs some kind of object is in contact with it. Here in the simulation of underwater excavation using dredging procedures, it uses same techniques mentioned in the previous paper. Underwater excavation is still a very difficult task for archaeologist’s. This paper gives information about simulating underwater excavation using immersive techniques.

We know about cultural heritages such as archaeological sites which are exhibited in the museums, but this paper explains about the underwater cultural heritage assets which are still not accessible to the common public and using virtual reality techniques this made accessible to experience the underwater heritage. With this advancement virtual underwater visit opportunity made easy. VR make us feel the underwater tours and used to train the archaeologists to dig deeper. Previous they used to use the dredging technology called airlift to collect object present underwater. The aim of this article is to provide a unique virtual experience to teach the basics of handling an airlift to future marine archaeologists. For modelling virtual sand, one of the simplest approaches is to use a height map which was discussed in the secondary paper. For simulating the sand, they use voxel-based approach presented by Geiger and extend it with dredging procedure using a device called airlift. This device is a pipe used for sucking debris from seabed. In the further part the article explains about the flowchart of computation steps of sand simulation.

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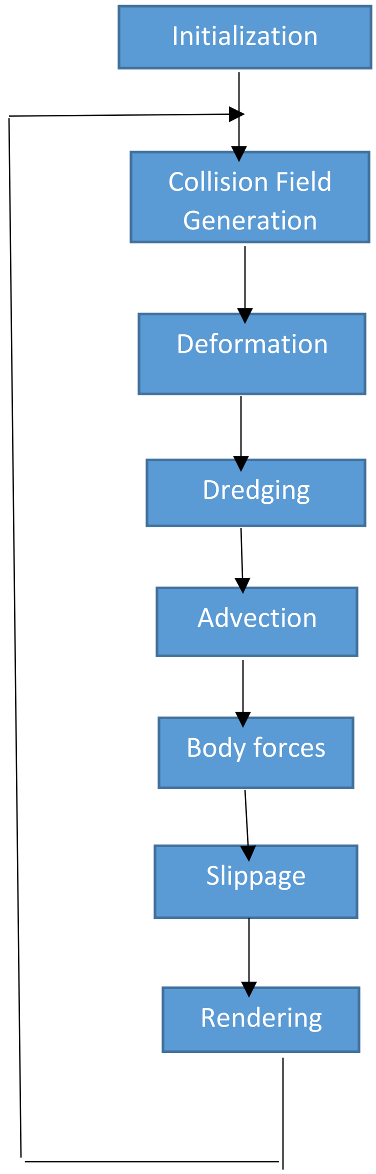

The collision Field Generation, Deformation, Advection were discussed in the previous secondary paper. Advection displaces the sand volume, but instead bases its displacement on the velocity of the voxels containing the soil. Body forces adds the gravitational forces to the whole body of the sand volume. Slippage computes the soil slippage, allowing the sand to create slopes without being displaced based only on the velocity and rigid-body forces.

Users can interact in real time with the excavation of objects based on the sand simulation designed for underwater environments. This simulation allow user for

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natural movement in a virtual environment. The VR simulation was tested on two computers suitable for running VR applications:

• a computer with an Intel Core i5-6500 CPU at 3.20 GHz, 16 Gbytes of RAM, and an Nvidia GeForce GTX 1070 with 8 Gbytes of memory; and

• a computer with an Intel Xeon E5-2620 v2 CPU at 2.1 GHz, 16 Gbytes of RAM, and an Nvidia GeForce GTX 980 with 4 Gbytes of memory.

Frame-time analysis of the application on the two tested computers. The frame rate spikes on the second computer, which featured an Nvidia GeForce GTX 980. There were few addition research topics to be excavated like support for multiple trenches and modifying the body force transformation to correctly simulate underwater properties.