Specialist Production Module
Renderman Ice Shader

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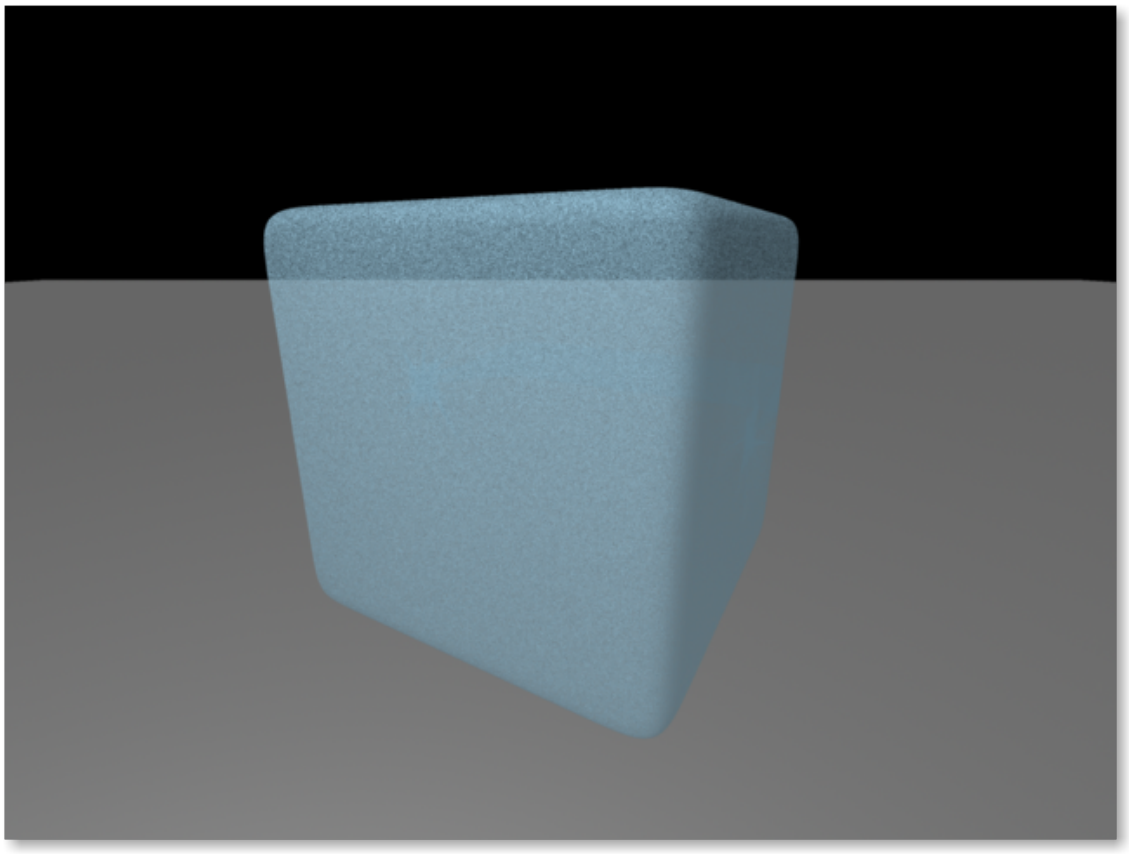
Project Overview

In this project I aimed to develop a *physically based* ***Ice Cube Shader*** in *Renderman Shading Language.*

Introduction



Todo

Initial Research

1.1 Experiments with real ice cube and light

1.2 Related research from other papers

1.3 So what exactly is Renderman?

1.4 Reading the documentation and tutorials

Superquads [4]

Pixar's Renderman documentation [3] was invaluable for understanding the huge complexity of renderer in enough detail to begin writing useful shaders for it.

Production

2.1 Initial Tests

2.2 Results

2.3 Unforeseen Problems

Conclusion

Bibliography

[1] http://dctsystems.co.uk/renderman/angel.html. `http://dctsystems.co.uk/RenderMan/angel.html`. Accessed: 25th May 2015.

A Renderman compliant renderer developed by Ian Stephenson, I initially chose to use it because it had support for geometry shaders that provided me with a simple way of creating an ice cube shape through the use of superquadrics. Unfortunately, the superquad shader did not work with shadows, the feature set is fairly dated compared to current PRMan releases and opacity support was too noisy (which presented a problem for a project that makes heavy use of translucency), forcing me to move on to using Pixar's Renderman instead.

[2] Pixar's renderman. `http://renderman.pixar.com/view/renderman`. Accessed: 26th May 2015.

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[3] Pixar's renderman documentation. `https://renderman.pixar.com/view/documentation`. Accessed: 26th May 2015.

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[4] The super egg and other super surfaces. `http://www.math.harvard.edu/archive/21a_fall_09/exhibits/superegg`. Accessed: 25th May 2015.

Although certain superquadrics are similiar in shape to an ice cube, notably the super egg, in the end I instead decided to write a displacement

[5] Anthony A. Apodaca and Larry Gritz. *Advanced RenderMan: Creating CGI for Motion Picture*. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 1st edition, 1999.

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[7] Makoto Fujisawa and Kenjiro T. Miura. Animation of ice melting phenomenon based on thermodynamics with thermal radiation. In *Proceedings of the 5th International Conference on Computer Graphics and Interactive Techniques in Australia and Southeast Asia*, GRAPHITE '07, pages 249–256, New York, NY, USA, 2007. ACM.

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[8] Tomokazu Ishikawa, Yoshinori Dobashi, Yonghao Yue, Masanori Kakimoto, Taichi Watanabe, Kunio Kondo, Kei Iwasaki, and Tomoyuki Nishita. Visual simulation of glazed frost. In *ACM SIGGRAPH 2013 Posters*, SIGGRAPH '13, pages 14:1–14:1, New York, NY, USA, 2013. ACM.

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[9] Theodore Kim, David Adalsteinsson, and Ming C. Lin. Modeling ice dynamics as a thin-film stefan problem. In *Proceedings of the 2006 ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, SCA '06, pages 167–176, Aire-la-Ville, Switzerland, Switzerland, 2006. Eurographics Association.

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[13] Masaaki Matsumura and Reiji Tsuruno. Visual simulation of melting ice considering the natural convection. In *ACM SIGGRAPH 2005 Sketches*, SIGGRAPH '05, New York, NY, USA, 2005. ACM.

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[14] Takanori Nishino, Kei Iwasaki, Yoshinori Dobashi, and Tomoyuki Nishita. Visual simulation of freezing ice with air bubbles. In *SIGGRAPH Asia 2012 Technical Briefs*, SA '12, pages 1:1–1:4, New York, NY, USA, 2012. ACM.

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[16] Ian Stephenson. *Essential Renderman.* Springer-Verlag New York, Inc., Secaucus, NJ, USA, 2007.

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[17] Alexey Stomakhin, Craig Schroeder, Lawrence Chai, Joseph Teran, and Andrew Selle. A material point method for snow simulation. *ACM Trans. Graph.*, 32(4):102:1–102:10, July 2013.

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