REAL-TIME STRAND-BASED HAIR RENDERING USING GUIDE HAIR INTERPOLATION AND DEPTH PEELING

Jonathan Liew Eu Jin & Rechard Lee
Mathematics Visualization Research Group (MathVis), Mathematics Computer Graphics Programme,
Faculty Of Science And Natural Resources, Universiti Malaysia Sabah
jonathan_liew_bs20@iluv.ums.edu.my & rechard@ums.edu.my

ABSTRACT

Hair is an important element in CGI and digital animation. However, it has been proven to be challenging to simulate hair properties when rendering hair. Lighting model that accounts for more than one light scattering direction renders physically-based hair strands in terms of visual appearance at the cost of performance, while overlapping hair strands produce incorrect occlusion when accounting for hair transparency. In this project, these challenges will be tackled.

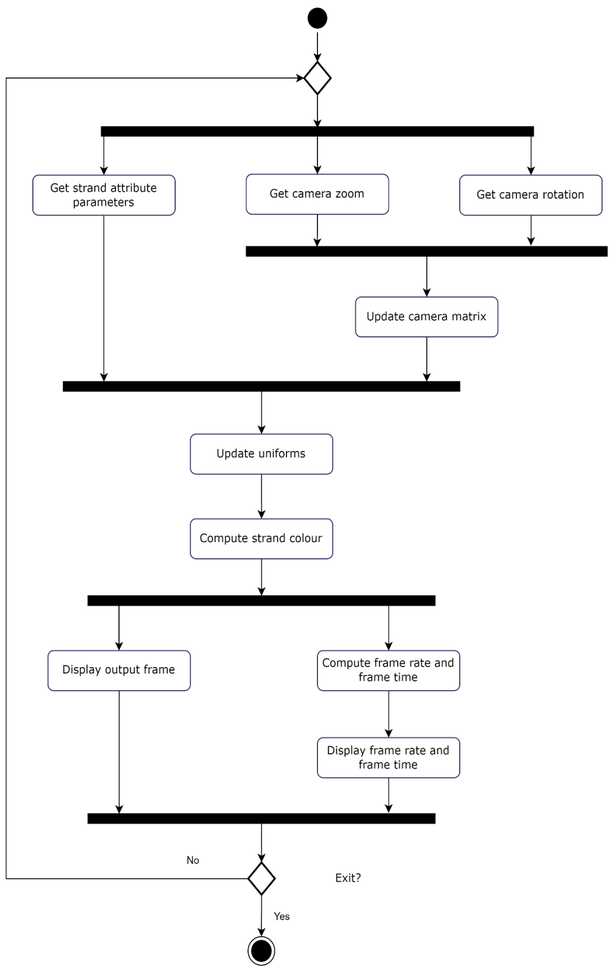
INTRODUCTION

Lighting model that accounts for more than one light scattering direction produces a more physically accurate representation hair model but takes a long time to render. The next challenge is sorting the hair strands based on their depth values alone results in renders with incorrect occlusion as strands are highly overlapping. Thus, techniques are required to improve the hair rendering performance and sort the hair strands using order-independent transparency technique when accounting for hair transparency.

OBJECTIVES

- To render hair geometry in real-time using guide hair interpolation.
- To adapt order-independent transparency for correct occlusion of hair strands using depth peeling.

METHODOLOGY



RESULTS AND DISCUSSION

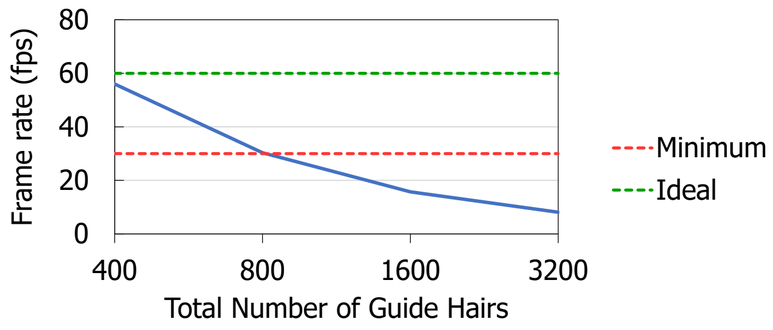


Figure 1 Rendering performance with increasing number of guide hairs used. Total number of hair strands are kept constant at 25600 strands.

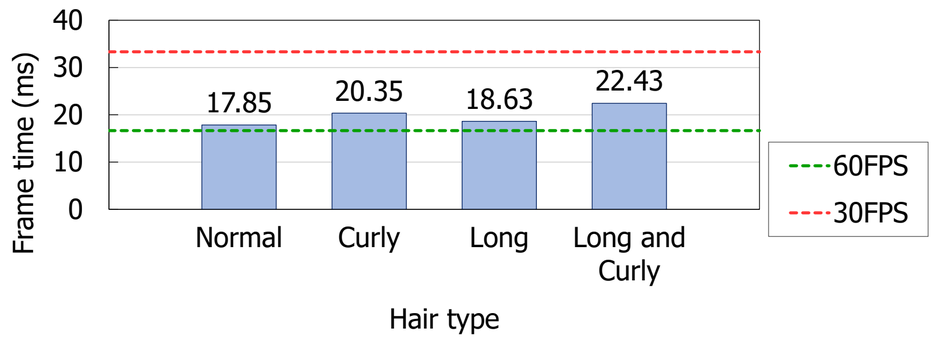


Figure 2 Average frame times of different hair type setups. Total number of hair strands are kept constant at 25600 strands.

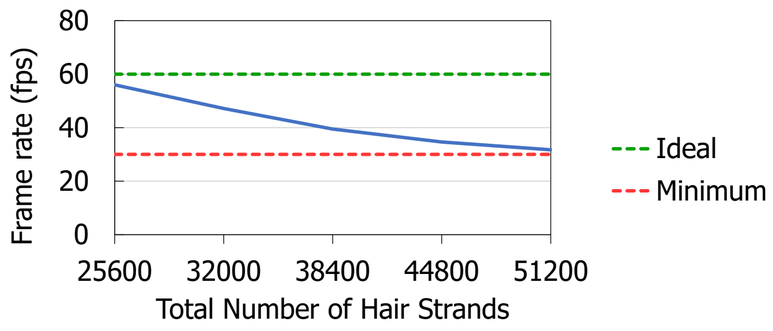


Figure 3 Rendering performance with increasing total number of hair strands used. Total number of strands per guide patch are kept constant at 64 strands.

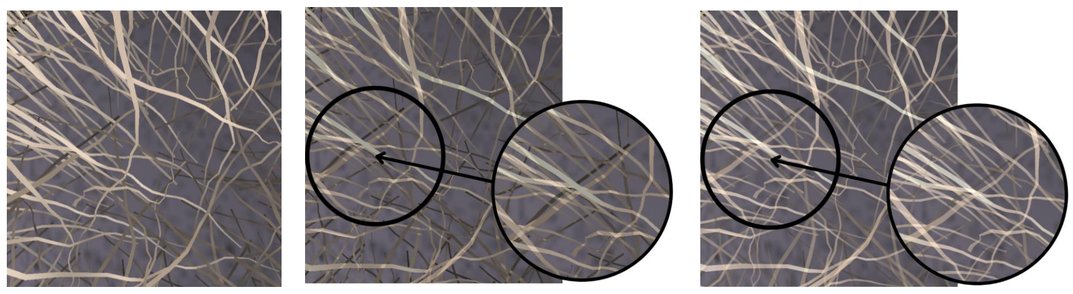


Figure 4 Zoomed in frame of rendered hairball model using without transparency (left), alpha blending (middle) and depth-peeling transparency (right).

CONCLUSION

- Tests carried out have shown both objectives of this project were achieved.
- Implementation of hair interpolation when rendering hair geometry achieved real-time performance.
- Depth peeling has allowed hair models to be rendered with correct occlusion.

REFERENCES

- Marschner, S. R., Jensen, H. W., Cammarano, M., Worley, S., & Hanrahan, P. (2003). *Light scattering from human hair fibers. ACM Transactions on Graphics (TOG),* **22**(3), 780-791.
- Enderton, E., Sintorn, E., Shirley, P., & Luebke, D. (2010). *Stochastic transparency. Proceedings of the 2010 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*.

ACKNOWLEDGEMENT

I would like to express my gratitude to my supervisor, Sir Rechard Lee, for providing guidance and assistance throughout the period of my dissertation. I would also like to express my gratitude to my family and friends who provided me support during my final year project. This study would not have been possible without their assistance.