Surface Flow Visualization Using the Closest Point Embedding

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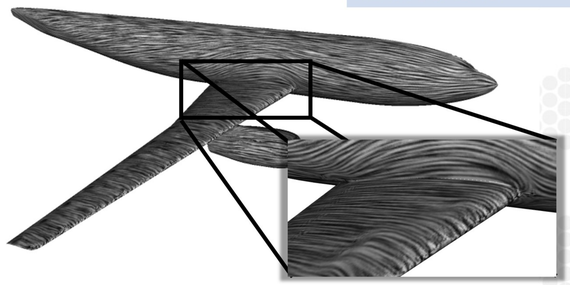
Results

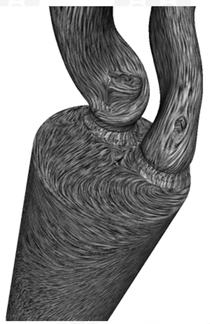
Closet Point Grid	384x191x55
Refined Grid	1536x764x220



Airliner

Build CPG	0.06s
Build Refined Grid	0.11s
UFLIC	0.12s

Closet Point Grid	144x222x472
Refined Grid	432x666x1416



Cylinder Combustion

Build CPG	0.07s
Build Refined Grid	0.21s
UFLIC	0.17s

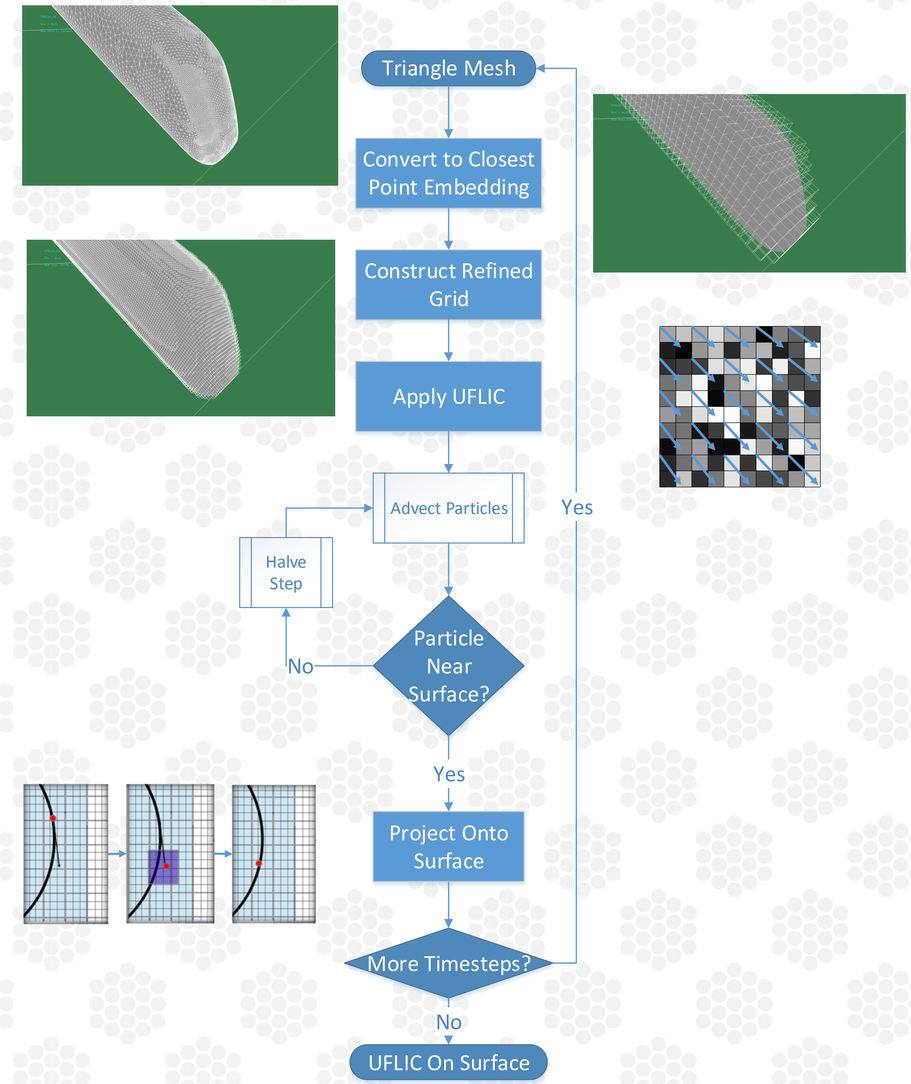
Introduction

We introduce a novel flow visualization technique for arbitrary surfaces. This new technique utilizes the closest point embedding to parameterize the surface, which allows for accurate particle advection on the surface as well as supports the unsteady flow line integral convolution (UFLIC) technique on the surface. This global approach is faster than previous parameterization techniques and prevents the visual artifacts associated with image-based approaches. Our approach is similar to the closest point method, a simple parameterizing technique for solving PDEs on embedded surfaces. By using the closest point embedding, parameterizing the surface can be done at near interactive rates and generating the LIC can be done at interactive rates, allowing flow visualization without the drawbacks of previous methods.

Conclusion

The closet point embedding is adapted to surface flow visualization. Previously, the surface was either parameterized or an image space based technique was used, with either being a compromise. The closest point embedding provides a flexible framework such that particle-based flow visualization techniques such as UFLAC can be implemented without the difficulties of parameterization or the ``popping'' and self-occlusion problems of image space based techniques.

Method



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