Visualizing very large-scale vascular structures interactively

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Coronary heart disease is the major cause of deaths in the United States as well as in other Westernized countries. Approximately 16.7 million people die from heart diseases every year according to estimates of the World Health Organization. The hemodynamic parameters are mostly unknown due to inherent difficulties to conduct experiments in the beating heart especially in the inner layers. In order to understand coronary heart disease, a complete analysis of coronary circulation is needed. Virtual/computational models depicting structure-function relation of the heart are imperative in this endeavor. In order to analyze these models, suitable visualizations are necessary. The complexity of these models, which includes vessels from the large proximal coronary arteries down to the capillary level (3 orders of magnitude difference in diameter), is challenging for the visualization since the resulting geometrical representations consist of several million up to a few hundred million triangles. This poster describes a novel method for rendering such models interactively employing mesh reduction and occlusion culling techniques. Due to the tree-shaped nature of the vasculature these techniques exploit the geometrical topology of the object to achieve a rendering speed of a few frames per second. This work was supported by NIH (2 R01 HL055554-06 (GSK)), NIMH (5 P20 MH60975), and NPACI (10195430 00120410).