Visualising Finite Element Solutions in Virtual Reality Environments

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Abstract

The design process for electrical machines is more and more accomplished by using simulation techniques rather than prototyping. Thus development time and costs can be reduced. To replace a prototype of an electrical machine with a simulation model, accurate simulation results are needed. This is achieved by using the Finite Element Method combined with a precise problem definition and a detailed mesh. The outcome of this is a large amount of solution data needs to be regarded and understood. Virtual Reality environments are suited to achieve these demands. They offer the possibility to easy explore the simulation results also of complicated geometries. This enhances the understanding of the machine and its behaviour, whereby the steps of the iterative design process can be shortened. Also, Virtual Reality Environments can be used to present research results to non experienced persons, providing them an insight into research objectives. In this paper, a post-processing software is presented, utilising the open source Visualisation Toolkit VTK to display results of Finite Element simulations. VTK provides a wide variety of visualization algorithms including scalar, vector, tensor, texture, and volumetric methods and advanced modelling techniques such as implicit modelling, polygon reduction, mesh smoothing, cutting, contouring, and Delaunay triangulation. The intention of the presented software named iMOOSE.trinity.vr is to adapt the visualization algorithm and techniques of VTK to the needs of Finite Element simulations. The interlinkage to Virtual Reality is realised by VISTA, providing the interface to graphics hardware and projection systems. The outlined qualities of iMOOSE.trinity.vr will de demonstrated by various application examples.