Exploiting XML to Provide a Uniform Interface for Graphical Representation of Finite Element Analysis

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The compelling attraction of the Internet is that it has made gigabytes of information ubiquitous to people of all walks of life. Most of this information is packaged in a user-friendly, easy-to-view format. Furthermore, the Internet is a tremendous vehicle that permits mathematicians and engineers to share technical data. However, most mathematical and engineering software applications produce files in a proprietary format, consumable only by that particular tool, or a limited set of tools. In order for these applications to accomodate other file formats, the application must be modified. Moreover, users of different applications must either wait for the modification, or try to arrive at an interoperable solution on their own.

In this paper, we describe a technique for representing the results of mathematical models by exploiting the power and expressivity of the Extensible Markup Language, XML[**?**, **?**]. This uniform representation facilitates sharing of information on the Internet, as well as viewing by many of the common tools, such as *Matlab*©, *Maple*©, *Tecplot*©, or a web browser. We allow the user of the application to choose the desired file format. We then use XML, together with a style sheet for the particular application, to produce a document viewable by the tool. An advantage of using XML is that if there is an application that is not currently supported or if a new application is available, we simply create a new style sheet without having to modify the code that generates the data.

Figure **??** represents an overview of our approach. The rectangle on the left of the figure represents the results of a mathematical model or computation. We have applied our technique to a case study that computes the results of a system of linear equations related to a viscoelastic finite element problem; however, the technique can be applied to most mathematical models where data needs some form of visualization. The output of the mathematical model is an XML representation of the data that, together with an XSLT style sheet, becomes input to a translator, represented by the rectangle in the middle of Figure **??**. An XSLT style sheet is tailored to a particular viewing tool and is used to translate the XML representation into a file for that particular tool. Finally, the translated file is used as input to the tool and can be viewed by the user. In the Figure, we illustrate four commonly used file formats for viewing data: Tecplot, Matlab, HTML and HDF.

In the full paper, we provide algorithms that describe the various XML/XSLT files, as well as an algorithm describing the translator that produces the viewable documents. We include description of our use of the simple API for XML, or SAX, and provide futher

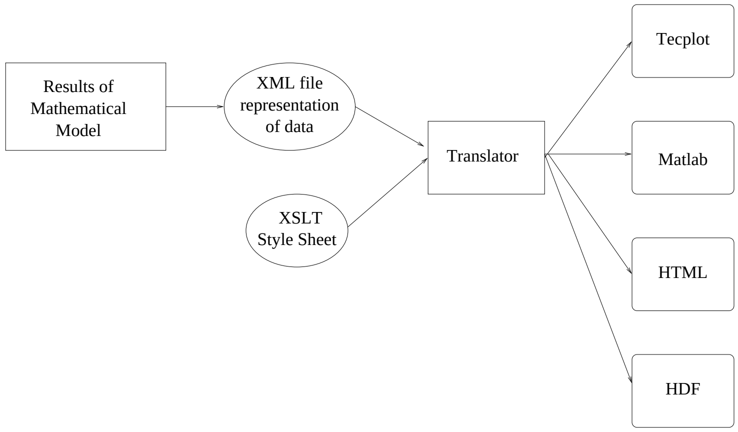

Figure 1. *System Overview*. **This figure provides an overview of the application of our technique. The Mathematical model is illustrated on the left of the figure as a rectangle. Output from the model is an XML file which, together with an XSLT style sheet, is input to a translator. The translator produces a file readable by a number of tools; the tools listed in the figure are Techplot, Matlat, HTML and HDF.**

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details about our approach[**?**, **?**]. Finally, we describe the results of applying our technique to the case study, solutions to a viscoelastic finite element problem.