

1046-65-1205 **L. Ridgway Scott*** (ridg@uchicago.edu), University of Chicago, 1100 E. 58th Street, 258
Ryerson, Chicago, IL 60637. *The Mathematics of Scientific Software Automation.*

Software automation refers to the automatic generation of software. The benefits of software automation over manual programming include reduced cost of software development and improved reliability. The main requirement for software automation is having rules that guide the software generation process. Fortunately, the mathematics at the heart of scientific simulation can provide such rules.

Software automation is being used in diverse areas of scientific computation. We will review its use in signal processing, computational quantum chemistry, numerical linear algebra, and solution of partial differential equations. We will contrast this approach with the traditional approach using conventional programming languages.

We give some details regarding the finite element method for approximating the solution of partial differential equations. We review the FErari method for generation of finite element matrices and indicate some mathematical ideas that this work introduces. In particular, it requires the study of optimization in some novel discrete spaces. We show how this provides a model for the general problem of software automation.

This represents joint work with Peter Brune, Jeff Hammond, Robert Kirby, Matt Knepley and Andy Terrel. (Received September 15, 2008)