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Numerical methods with LuaLaTeX

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Abstract An extension of TeX known as LuaTeX has been in development for the past few years. Its goal is to allow TeX to execute scripts written in the general purpose programming language called Lua. There is also LuaLaTeX, which is the corresponding extension for LaTeX.

In this paper, we show how LuaLaTeX can be used to perform tasks that require a large amount of mathematical computation. With LuaLaTeX instead of LaTeX, we achieve important improvements: since Lua is a general purpose language, rendering documents that include evaluation of mathematical algorithms is much easier, and generating the pdf file becomes much faster.

Introduction

TeX (and LaTeX) is a document markup language used to typeset beautiful papers and books. Although it can also do programming commands such as conditional execution, it is not a general purpose programming language. Thus there are many tasks that are easily done with other programming languages, but are very complicated or very slow when done with TeX. Due to this limitation, auxiliary programs have been developed to assist TeX with common tasks related to document preparation. For instance, bibtex or biber to build bibliographies, and makeindex or xindy to generate indexes. In both cases, sorting a list alphabetically is a relatively simple task for most programming languages, but it is very complicated to do with TeX, which is why auxiliary applications written in standard programming languages are used to prepare the bibliography and index.

Another shortcoming of TeX is the computation of mathematical expressions. One of the most common uses of TeX is to compose mathematical formulas, and it does this extremely well. However TeX is not good at computing mathematics.