

Typesetting Mathematics - A Brief User-Guide

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Enhanced with some more complex additions from a document [2] by *Ted Harding*

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This document is an all-too-brief user-guide to a system for typesetting mathematics. That system was originally developed for, and ran on, the UNIX™ and GCOS™ operating systems over half a century ago and has stood the test of time. Today, it produces output in a range of formats such as Postscript and PDF, that can then be rendered onto paper using a laser printer or phototypesetter or onto the more environmentally-friendly high resolution desktop display or tablet.

At the heart of the system is a mini-language in which mathematical expressions are described. That language was itself "designed to be easy to use by people who know neither mathematics nor typesetting" [1] although it does really demand that persons using that language can at least "read" the expression, even if those same persons do not understand that expression.

It has been argued [1] that enough of the language can be learned in an hour or so to set such in-line expressions as say $\lim_{x \rightarrow \pi/2} (\tan x)^{\sin 2x} = 1$, or to display equations like

$$\begin{aligned} G(z) &= e^{\ln G(z)} = \exp\left(\sum_{k \geq 1} \frac{S_k z^k}{k}\right) = \prod_{k \geq 1} e^{S_k z^k / k} \\ &= \left(1 + S_1 z + \frac{S_1^2 z^2}{2!} + \dots\right) \left(1 + \frac{S_2 z^2}{2} + \frac{S_2^2 z^4}{2^2 \cdot 2!} + \dots\right) \dots \\ &= \sum_{m \geq 0} \left(\sum_{\substack{k_1, k_2, \dots, k_m \geq 0 \\ k_1 + 2k_2 + \dots + mk_m = m}} \frac{S_1^{k_1}}{1^{k_1} k_1!} \dots \frac{S_2^{k_2}}{2^{k_2} k_2!} \frac{S_m^{k_m}}{m^{k_m} k_m!} \right) z^m \end{aligned}$$

For some end-users, the time-line in that argument is questionable [3], at least for the case of expressions as complex as the second example.

The mini-language, **eqn**, interfaces directly with the phototypesetting language that is interpreted by **troff** [4] and its descendant **ditroff** [5] (a.k.a. heirloom **troff**) and other tools such as James Clark's **groff** [6] that have been written to provide an easy-to-obtain and non-proprietary replacement for **troff**. Such tools allow those same mathematical expressions to be embedded in the running text of a manuscript, and the entire document produced in one process. This user's guide is an example of its output. Approximate (to various degrees) renderings of equations can be produced from that same language on inkjet or dot-matrix printers or even **tty** (Teletype) devices such as a terminal emulator using alternative device targets.

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