Review of MathType 5.2

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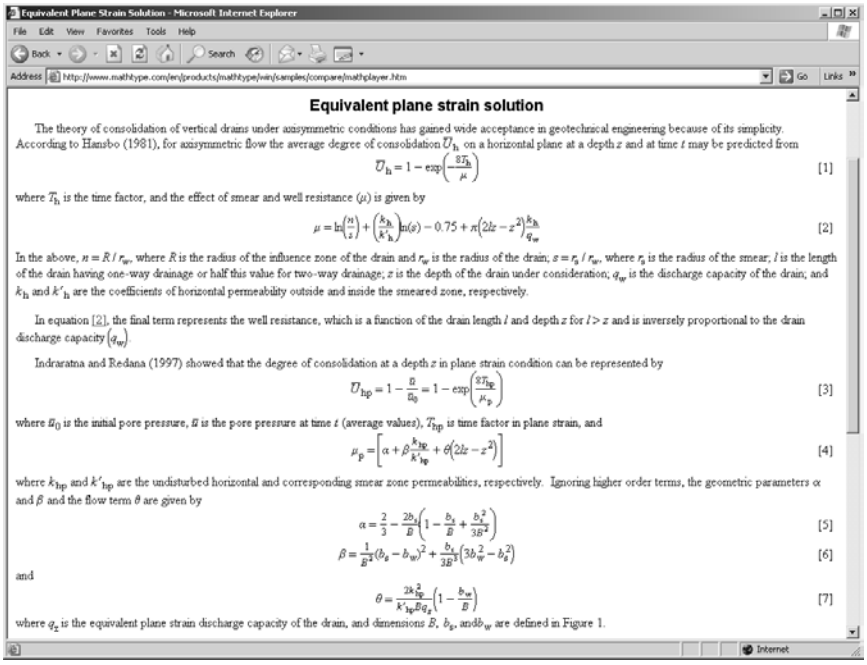
MathType is the professional version of the Equation Editor that comes with Word, WordPerfect and other applications. As many readers will probably know, MathType is a mathematical equation editor for personal computers running Windows or MacOS that allows one to create complex equation through "point-and-click" techniques. These can afterwards be used in your documents or easily exported to web pages. Those completely unfamiliar with it are referred to Douglas Quinney's review of MathType 4 [1] and Jeff Waldock's review of MathType 5 [2]. The present review emphasises on the new features of the 5.2 upgrade and cover some interoperability issues with other tools that could be interesting for readers of *MSOR Connections*.

As described in [1,2] there are a number of benefits in using MathType rather than the traditional Equation Editor. As of version 5 the major new feature is the way MathType exports equations for use on the web. Nowadays, that many of us have to make available their documents online in an accessible manner, this is a significant improvement.

Why upgrade?

If you already have MathType 4 or 5, and you are only using it for writing equations in an editor, then the new upgrade may not offer you significant features, unless you are using Office 2003. You also may want to upgrade if you want to keep your web pages up-to-date, compatible with MathPlayer 2.0 and take advantage of it's accessibility features.

Note that, although Design Science improved the 'multiple monitor support', I am still experiencing similar problems to previous versions. If you enjoy using multiple monitors, you may be disappointed by the fact that you cannot use the right-click menu to easily send the MathType window from one monitor to the other (of course this is a minor problem and could be a compatibility issue with my card).


Equivalent Plane Strain Solution - Microsoft Internet Explorer

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Equivalent plane strain solution

The theory of consolidation of vertical drains under axisymmetric conditions has gained wide acceptance in geotechnical engineering because of its simplicity. According to Hansbo (1981), for axisymmetric flow the average degree of consolidation $\overline{U}_h$ on a horizontal plane at a depth z and at time t may be predicted from

$$\overline{U}_h = 1 - \exp\left(-\frac{8T_h}{\mu}\right) \quad [1]$$

where T_h is the time factor, and the effect of smear and well resistance (μ) is given by

$$\mu = \ln\left(\frac{n}{s}\right) + \left(\frac{k_h}{k'_h}\right)\ln(s) - 0.75 + \pi\left(2lz - z^2\right)\frac{k_h}{q_w} \quad [2]$$

In the above, $n = R/r_w$, where R is the radius of the influence zone of the drain and r_w is the radius of the drain; $s = r_s/r_w$, where r_s is the radius of the smear; l is the length of the drain having one-way drainage or half this value for two-way drainage; z is the depth of the drain under consideration; q_w is the discharge capacity of the drain; and k_h and k'_h are the coefficients of horizontal permeability outside and inside the smeared zone, respectively.

In equation [2], the final term represents the well resistance, which is a function of the drain length l and depth z for $l > z$ and is inversely proportional to the drain discharge capacity (q_w).

Indraratna and Redana (1997) showed that the degree of consolidation at a depth z in plane strain condition can be represented by

$$\overline{U}_{hp} = 1 - \frac{\overline{u}}{u_0} = 1 - \exp\left(\frac{8T_{hp}}{\mu_p}\right) \quad [3]$$

where u_0 is the initial pore pressure, $\overline{u}$ is the pore pressure at time t (average values), T_{hp} is time factor in plane strain, and

$$\mu_p = \left[\alpha + \beta\frac{k_{hp}}{k'_{hp}} + \theta\left(2lz - z^2\right)\right] \quad [4]$$

where k_{hp} and k'_{hp} are the undisturbed horizontal and corresponding smear zone permeabilities, respectively. Ignoring higher order terms, the geometric parameters α and β and the flow term θ are given by

$$\alpha = \frac{2}{3} - \frac{2b_s}{B}\left(1 - \frac{b_s}{B} + \frac{b_s^2}{3B^2}\right) \quad [5]$$

$$\beta = \frac{1}{B^2}(b_s - b_w)^2 + \frac{b_s}{3B^2}\left(3b_w^2 - b_s^2\right) \quad [6]$$

and

$$\theta = \frac{2k_{hp}^2}{k'_{hp}Bq_z}\left(1 - \frac{b_w}{B}\right) \quad [7]$$

where q_z is the equivalent plane strain discharge capacity of the drain, and dimensions B, b_s, and b_w are defined in Figure 1.

Internet

Fig 1 Sample page created using MathType

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Trying out the new features

Over the last few years, having to write plenty of content for the web-based system WALLIS, one of the nightmares, as you probably imagine, was to write, store, and maintain the mathematical expressions of the available material. Although we were not using MathType's export capabilities *per se* (since most of the development happens in Linux) I certainly appreciate the ease it provides for writing equations and including them in technical documents. Perhaps not the best tool for a developer (see [3] for other tools for developers from Design Science), MathType is particularly useful for students, teachers, lecturers and researchers who want to communicate mathematics. For those who wish to avoid the – alleged - complexity of LaTeX and related solutions (for example, [4]), MathType offers a perfect alternative.

The new version offers significant improvements and the MathML that MathType produces is accurate both for browsers that support MathML natively (Mozilla, Amaya) and for Internet Explorer with the MathPlayer plugin. In fact, now that accessibility is a major issue, which everyone should take into consideration, MathPlayer is one of the few working attempts to produce more accessible mathematics. Apart from its zoom capabilities, its *'Speak Expression'* command and the ability to interface with popular Windows screen readers (such as WindowEyes and JAWS) make your pages even more accessible.

Interoperability issues

The use of MathType for writing and editing expressions in a document (or standalone) means that you can copy-paste them in other documents or programs. Once you select an expression (or part of it), it is copied to the clipboard in the format specified at the *Translator* menu (various versions of MathML and LaTeX). Afterwards, you can paste it to your document or program. For instance, you can paste it in your LaTeX document thus making it easier to write expressions. Similarly, expressions from a document can be pasted to a Computer Algebra System (if this supports MathML). We copied several expressions from a paper that a colleague is writing into Maple and (with a few changes to conform with Maple's notation) we were able to validate that he has written them properly and his induction is correct.

On the other hand, it was really disappointing to find out that you cannot copy MathML or LaTeX expressions back to MathType unless they were produced by it (including the MathType data in your translation as comments). This makes editing of already written documents impossible; a feature that many users would surely appreciate. Fortunately, we heard that Design Science is developing a version of MathType that will import MathML.

Conversion to PDF, works perfectly (at least with the full version of Acrobat 5). Also, inserting an OLE (Object Linking and Embedding) to MS Paint or other applications seems reasonably steady. Finally, using expressions as OLE inside PowerPoint works satisfactorily but the scaling problems reported in [2] are still noticeable. Sometimes, enlarging the equation inside the application produces superscripts, subscripts and fraction lines that look awkwardly large. Therefore, it is recommended that you use the *'Define Sizes'* command inside MathType to change the sizes. The advantage of this is that you can define different sizes for your sub/super scripts and will make all the fonts of your expressions the same size, which can be a demanding process if done manually.

Conclusion

MathType is particularly useful for users of Windows and MacOS who need to write professionally typeset mathematics, export them to other applications that support MathML, OLE and particularly on the web. If you are already using MathType the upgrade has little to offer unless you want to use Office 2003 or you expect the readers of your pages to use MathPlayer 2. If you are not using it you can read more in [1,2] and download a demo version. You would surely appreciate its capabilities. Similarly, educational institutions that use Windows as the main student environment, will appreciate the suite of tools which Design Science offers. Especially for students who take their first steps in browsing and interacting with mathematics, MathType and MathPlayer can provide a much more pleasant experience, support their learning and help them exchange mathematical documents.

References

[1] Douglas Quinney, 1999. Review of MathType 4. *Maths&Stats,* available online: http://www.bham.ac.uk/ctimath/reviews/aug99/mathtype4.pdf
[2] Jeff Waldock, 2002. Review of MathType 4. *MSOR Connections*, available online: http://ltsn.mathstore.ac.uk/newsletter/ feb2002/pdf/mathtype5.pdf
[3] http://www.mathtype.com/en/reference/webmath/
[4] http://hutchinson.belmont.ma.us/tth