TECHSIGHTING

SOFTWARE

Equation Writing Made "Friendly"

Incorporation of mathematical characters in technical documents is not a standard function of word processors. Most authors instead opt to insert handwritten characters and expressions after printing from the word processing progam. Design Science has alleviated many of these pitfalls with the production of MathType, version 3.6. Many authors are already familiar with the predecessor of MathType known as Equation Editor. The notable differences in this upgrade are (i) its ability to save files (in various formats), (ii) increased selection of mathematical characters and expressions, (iii) customization of toolbars, (iv) a printed manual, and (v) an interface with Microsoft Word. As the name suggests, MathType is useful only for mathematical typesetting; it does not solve the equations it formulates.

MathType 3.6
Design Science, Inc.
Long Beach, CA.
$129.
800-827-0685
www.mathtype.com

MathType uses a font that eases equation building, with an extensive collection of more than 275 mathematical characters and functions, including many geometric expressions. MathType's font is built into the program and does not appear on any menus, precluding use with character selection programs such as PopChar (Unisoftware Plus) and TypeTamer (Impossible Software). To create an equation, the author clicks on the tool bar containing drop menus of mathematical characters and functions. After selection, the choice appears in MathType's window complete with ruler and adjustable tab stops. Spacing and sizing of expressions are controlled automatically from within the program and are in accordance with the rules of mathematical typesetting. These settings, however, may be modified. As one might expect, repetitive functions, expressions, templates, and frequently used characters may be added to the toolbar. Editing the equation is accomplished by either tabbing through insertion points or mouse-clicking at the desired point.

Upon completion, the equation is selected and, with copy and paste commands, imported into the desired program. MathType employs standard save formats (PICT and Postscript for the Macintosh); its equations can be exported into word-processing, drawing, and desktop publishing programs. MathType equations can also be saved in GIF format, which is frequently used on the Internet for its transfer speed and resolution. The MathType format is not compatible with no-frill text editors [for example, SimpleText (Apple Computer)] and text abbreviation programs [for example, TypeIt4Me (www.hebel.net/~rettore)]. In saving files, MathType features an automatic file numbering function to save sequential equations without the need to remember the name of the last saved document. In addition, the program is interfaced with Microsoft Word. For example, clicking on a MathType equation in a Word document opens the equation in the MathType window for editing. A handy function available in Word's menu is equation numbering, which places a number next to a given equation. Although earlier versions of Word are compatible with MathType, they have reduced capabilities. MathType is not difficult for beginners to learn and help is available from multiple sources, including from within the program. The manual for MathType is clearly written, and the excellent tutorial section is noteworthy. Technical support is free of charge, by telephone or e-mail.

MathType works quickly and effortlessly on both Power Macintoshes and standard 680 × 0 processors operating with System 7.1 or newer. MathType is available also for Windows-compatible computers, and the company notes that files can be interchanged easily between formats. In summary, MathType is a worthy and convenient method to formulate equations in a written document.

—FRANK HOOVER

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TECHSIGHTING

NET TIP

Netscape's Gecko and You

The "Gecko" in the title refers to the code name for the main component of Netscape's new generation of World Wide Web browser, the layout engine. The layout engine is the heart of a browser. It takes the raw information that you point to with a URL and turns it into viewable content, complete with images, frames, and so forth. Because Gecko will form the core of the fifth-generation browser from Netscape, we thought we'd take a look under the hood of this new technology. In a previous column, we covered the 5.0 browser from Microsoft, Internet Explorer 5.0 (IE5) (*1*).

Why should a scientist care about the next generation of browsers—let alone a new type of browser layout engine? After all, the 4.0 browsers seem to view complex Web documents, help play sound and videos, and save lists of bookmarks just fine. Can there be anything more? In short, yes, much more. The Web is evolving rapidly. All is changing—everything from the basic format of a Web document to how you search for a Web site.

Gecko is not yet finished, so this report is based on what can be gleaned from the development Web site (www.mozilla.org) and published reports. First, the way in which Gecko is being built differs from how Microsoft built IE5. Netscape opened up development of Gecko to the programming public. Although it may seem odd for a software company to open up its code "crown jewels" to all, open source development has worked for other large projects, such as the development of the programming language Perl. When released as a commercial product, however, Gecko will represent the first major consumer product developed by this method. Because of the diverse population of eager software developers that are involved, the finished product should incorporate many new features.

The first thing that strikes you when you look at Gecko is its small size. The basic components can fit on a single floppy disk. Compare this to the size of other current browsers (15 MB or greater), and you may think that they took a giant step backward. Actually, in this case, smaller is better. The goal with Gecko is to create not only a new layout engine for the browser, but a component that can be embedded into other pieces of software that can run in non–personal computer applications. For example, you could have a browser in a cell phone, a pager, or even a piece of lab equipment.

The next notable feature of Gecko is that Netscape has decided to follow the rules put forth by the World Wide Web Consortium, the body that creates standards for how Web documents are created. For the typical Web site developer, this means that it should get easier to create cross-platform Web pages because Microsoft has essentially adopted the same standards. This is critical for developers like scientific journals, for which it can be difficult to create a rich user interface that can be viewed by a mass audience. The Web standards include HTML 4.0, cascading style sheets, the document object model, and XML.

With the adoption of XML, or extensible markup language, for the first time a Netscape browser will allow you to write content in XML as well as HTML. Because XML is likely to be a key component in how we package and transfer complex scientific information in the future, this is a major milestone for the Web. Microsoft implemented an XML parsing engine in its 4.0 browser and has fully supported XML document technology in its soon-to-be-released 5.0 version.

There is more, but the basic point is that the browser is evolving to serve as the primary window into information, scientific and otherwise. Don't be surprised when you find browsers embedded into scintillation counters, ultracentrifuges, and other lab equipment. Just think about how hard it is to find the user's manual for that old Sorvall in the corner, and you see that this is not as radical as it seems.

—ROBERT SIKORSKI AND RICHARD PETERS

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TECHSIGHTING

POLYMER CHEMISTRY

Designer Jell-O

Bioengineers are constantly looking for methods to develop molecules that have biological applications. Polymer hydrogels that behave in a predictable manner in response to stimuli are one example. Such "smart" biomaterials change their physicochemical property in response to various stimuli. In the field of medicine, for instance, such molecules hold promise for the targeted delivery of drugs or tracer agents.

A recent report in *Nature* adds to this body of knowledge and provides an interesting twist: the authors created hybrid hydrogels made of synthetic polymers and coiled-coil protein domains (*1*). By using a well-defined protein motif (the coiled-coil motif) as the crosslinks between synthetic polymers, the scientists postulated that they could more easily control the behavior of the hydrogel in response to external stimuli. In the report, they demonstrate that they were able to synthesize biopolymers that exhibit specific volume changes in response to changes in temperature.

First, they synthesized a metal-chelating monomer, *N*-(*N′*,*N′*-dicarboxymethylaminopropyl)methacrylamide. After characterizing the physical chemistry of this monomer with thin-layer chromatography, mass spectrometry, and nuclear magnetic resonance, they copolymerized it with *N*-(2-hydroxypropyl)-methacrylamide. Next, they produced histidine-tagged coiled-coil motifs in *Escherichia coli* and purified the proteins with Ni–nitrilotriacetic acid metal-affinity resin. They purified two such motifs: one (CC1) was a segment of the stalk region of kinesin, a motor protein (261 amino acids); the other (CC2) contained a sequence designed de novo and a terminal histidine tag, separated by a non–coiled-coil region (78 amino acids). The identity and purity of these proteins were verified by SDS–polyacrylamide gel electrophoresis, amino acid analysis, and matrix-assisted laser desorption ionization time-of-flight mass spectrometry. The biophysical characteristics of these motifs were studied with circular dichroism experiments. These tests revealed that the proteins had spectra consistent with α-helical coiled-coils. Denaturation studies revealed a melting point of 35°C for CC1 and ~108°C for CC2.

To prepare the hybrid hydrogel, the authors performed a simple trick; they mixed the linear hydrophilic copolymer with excess Ni^{2+}. The copolymer-Ni^{2+} complex was then separated from the excess Ni^{2+} by using size exclusion chromatography. Next, each recombinant protein was mixed separately with the charged polymer, and the mixed solutions were dropped on Teflon sheets (50 μl per drop) and allowed to air dry. The dried gels were then desiccated and used for swelling studies. The dried gels were hydrated in buffer, and their behavior was monitored with an optical microscope. The extent of gel swelling was determined by measuring the two-dimensional changes of gel pieces of various shapes. A gel containing CC1 underwent a sudden collapse of volume down to 10% of its equilibrium volume when the temperature was raised over 39°C. This temperature is consistent with the melting temperature of CC1, and the authors propose that the change in the gel behavior is caused by a change in conformation of the CC1 coiled-coil. The other gel that contained CC2 did not exhibit any change in volume between 25°C and 70°C, as predicted by the higher melting temperature of CC2.

By linking well-defined protein motifs to well-characterized synthetic polymers, the authors have built a system where hydrogels can be created with a number of unique physicochemical properties. By merely modifying the coiled-coils with molecular biological techniques, hydrogels with various transition temperatures can be generated. Such gels would be of great use for the delivery of therapeutic proteins.

—RICHARD PETERS AND ROBERT SIKORSKI

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TECHSIGHTING

SOFTWARE

Digital Dating

Protection of intellectual property depends on establishing precedence of discovery, traditionally by the witnessing and signing of a researcher's notebooks by another party. As data and notebooks evolve from paper products to the virtual world, a new way to verify the exact content of original computer documents and to establish the creation date is required.

Software such as DigiStamp's e-Time Stamp (*1*) and Little Acorns Company's Date Stamp (*2*), allow users to record and time-date stamp electronic documents on their own laboratory computers (Mac, Windows, UNIX). Based on the sequence of bytes in the document, a "fingerprint" in the form of a unique number is generated by the software. The fingerprint is uploaded to the host enterprise (the makers of the software) where it is encrypted, together with the date, creating a new document called a certificate. The host then returns the certificate to the originator, who stores it until needed. The encryption scheme employs a common key access system (*3*), which enables owners of the key (the originators) to see, but not modify, the contents of the certificate.

This design has several advantages: Fingerprints are made on the user's personal computer, so no copies of the file are transferred and, because rigorous encryption algorithms are employed, information security is maintained. Also, since the fingerprinting algorithm depends only on bytes, any digital document (pictures, plots, text, and so forth) can be fingerprinted. Further, because the fingerprint of a document is a function of the unique sequence of bytes in it, comparison of a document with the fingerprint in the certificate readily reveals file tampering or alterations.

—KEVIN AHERN

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