FORMULATOR v3.8

MathML Suite

Mastering MathML Presentation Markup

Published By Hermitech, Laboratory of Mathematical and Modeling Software, Zhytomyr, UKRAINE

E-mail: *info@mmlsoft.com* Web: *http://www.mmlsoft.com*

Copyright © 2003-2008 by Hermitech, Laboratory of Mathematical and Modeling Software. All rights reserved.

Mastering MathML Presentation Markup

Mathematical templates in Formulator provide dual facilities to edit formulas. In accordance with the MathML approach to mathematics coding, there are "Presentation" and "Content" templates. The first group of templates is of special interest to users having publishing needs and has a lot of presentation abilities: fractions, radicals, sums, integrals, products, matrices, various types of brackets and braces, and many other templates. The second group is oriented on mathematical semantics and is extremely useful when the meaning of the entered formula is critical.

Presentation		×
≠ ab *÷ ≮ ∉	λ βρ βΩ	ΞÍ
(□) ¹⁰ /□ [] ⁰ Σ ⁰ ∫ ₂ ⁰	🗓 🗃 🎞 🎇	

A group of Presentation mathematical templates comprises:

- relational and logical symbols
- spaces templates
- operator symbols
- arrow symbols
- set theory symbols
- special constants
- miscellaneous symbols
- Greek characters (lowercase)
- Greek characters (uppercase)
- differentiation templates
- fence templates
- fraction and radical templates
- subscript and superscript templates
- summation templates
- integral templates
- underbar and overbar templates
- labeled arrow templates
- products and set theory templates
- table templates

box templates

Token Elements

These elements can be just typed and their kind will be determined automatically if the current style is 'Math'. If a user exactly knows what kind of token elements is needed then a Style menu item can be used to specify the kind (mi, mo, mn). Besides, there is a toolbar b for "mo" equivalents of space elements.

There are token elements that neither will be detected automatically when typing, nor have a special toolbar (ms, mspace, mglyph). They can be edited manually, using "MathML Tree" or "MathML Text" options. See the next figures for the explanation.

🛃 Formulator - [Formul1]	
💁 File Edit View MathML Window Help	
📄 🤌 🔚 🐰 🗈 🖆 🖭 I	= = 🖓 🖓 🔎 🍯 📀
⊡ · math mglyph	Entity name: mglyph Property max median median menclose merror mfenced mfrac mglyph mi min min minus mlabeledtr mmultiscripts mn mo mode moment momentabout mover mpadded mphantom mrow
Expression MathML Tree MathML Text XHTML	lms 🗾
	11.

Formulator - [Formul1]	
Eile Edit View MathML Window Help	
- 🗋 🔌 🔚 🐰 🗈 🛱 🛤	🛱 🗧 <u>(</u> 🖓 🖓 🎽 🕘
⊡- math mglyph	Entity name: mglyph
	Property Value
	alt 1
	Class color fontfamily fontsize fontstyle fontweight id index mathbackground mathcolor mathsize mathvariant style xlink:href xref

🚯 Formulator - [Formul1]		
💁 Eile Edit View MathML Window Help		_ 8 ×
📄 🔌 🔚 🐰 🗈 🕼 🖻 1	= = 🎧 🖓	0 😓 🞑
⊡~ math mglyph	Entity name: mglyph	_
	Property	Yalue
	alt	1
	index	125
	fontfamily	
		Blackadder ITC
		Bodoni MT Black
		Bodoni MT Poster Com
		Book Antiqua Bookman Old Style
		Bradley Hand ITC
		Britannic Bold Broadway
	[[Brush Script MT
	font name (deprecated)	Calisto MT
	Toric Hallio (doprocacida)	Castellar
Expression MathML Tree MathML Text XHTML		Century
		Century Gothic

ø	Form	ulato	r - [Fo	rmul1]							- D ×
<u>o</u>	Eile	<u>E</u> dit	⊻iew	<u>S</u> tyle	Si <u>z</u> e	Options	<u>W</u> indow	<u>H</u> elp			_ 8 ×
]	_				Pr : (esentation ≠ ab ×÷ □) 叩n []°	<u>►</u> ∉ λ % Σ□ ∫□ ⊒ ∃	β Ω Π= 13	×
		Expres	sion)	MathML	Tree	(MathML	Text XH	TML			
							Si	ze: Regular	Style: Other	Zoom: 300 %	• <u>P</u> //

Fractions and roots

The "mfrac" element is used for fractions; the "msqrt" element is used for square roots, while the "mroot" element is used to draw radicals with indices.

Fractions and roots can be inserted via **1**/1 toolbar. There are several buttons which take into account different available forms of fences and roots. Fine tuning or specific editing features can be accessed via the "MathML Tree" and "MathML Text" options. For example, the following figures show how to insert the "bevelled" version of a fraction and then convert it to a simple variant using "MathML Tree" editing mode.

🚮 Form	ulato	r - [Fo	rmul1]						×
🚺 File	Edit	View	Style	Size	Options	Window	Help	_ 8	×
						Pres	entation	⊻.	•
	-	/	/			≠ (::)	ab ×+ ↖ ∉ λ % β ™a □° Σ¤ ∫₽ 및 글 Π¤	Ω []´	
	/		2				II II/I II II/I II/II √IFull-size diagonal fraction (Ctrl-	- <u>n</u>	
Full-size o	Expres liagona	sion)	MathML on (Ctrl	. Tree +/)	(MathML	Text (XH	: Regular Zoom:	300 %	

🚮 Formulator - [Formul1]			
🛃 Eile Edit View MathML Window	<u>H</u> elp		_ 8 ×
🗋 🔌 🖪 🗶 🗈			
⊡ ·· math ⊟ ·· mrow		Entity name: mfrac	•
⊡ mfrac ⊕ mn		Property	Value
ter mn		bevelled	true 💌
			false
		bevelled	
		change the way how fraction	n is displayed
Expression MathML Tree Mat	hML Text (XHTML)		
			li.

ø	S] F	orm	ulato	r - [Fo	rmul1]	1										_ 🗆	×
A state	ě	<u>F</u> ile	<u>E</u> dit	⊻iew	<u>S</u> tyle	Size	Options	<u>W</u> indow	<u>H</u> elp							_ 8	×
Г								Pres	entatio	n						×	
								ŧ	ąþ	×÷	<u>K</u>	∉ ?	x %	β	Ω	Π	
L								(11)	"/c	[]"	Σ::	<u>}</u> :] 🖬	ΠΞ			
L			_	—													
L			9	2													
																	•
0	0	D	Expres	sion)	MathML	. Tree	(MathML	Text XH	TML								
								Si	ze: Regul	ar	Styl	le: Othe	er	Zoom	: 300 %	6 P	1//

Note that the button for the long division is also placed into this toolbar, but used another scheme of MathML encoding, the so-called, "enclosing notation" (menclose).



Scripts and Limits

These are the elements of the	he "Scripts and Limits" group:
msub	attach a subscript to a base
msup	attach a superscript to a base
msubsup	attach a subscript-superscript pair to a base
munder	attach an underscript to a base
mover	attach an overscript to a base
munderover	attach an underscript-overscript pair to a base
mmultiscripts	attach prescripts and tensor indices to a base

MathML Weaver works with script and limit schemata via []^{*} toolbar:



Simple elements of this schemata are implemented as partial cases (the first buttons line – msub, msup, msubsup; the last buttons line – munder, mover, munderover), but the most powerful MathML element here is "mmultiscripts", since it is able to encode all the complicated parent-child slots relations of the script and limit schemata.

The next two figures show how the "mmultiscripts" forms the equivalent MathML tree for the different cases of scripts. Note application of the <none/> and <mprescripts/> elements.

🚯 Formulator - [Formul1]		×
🙍 Eile Edit View Style Size Options Window	w <u>H</u> elp	×
0 4 5	Presentation	×
$^{2}\Lambda^{4}$ 3 R	≠ ab *÷ ≮ ∉ λ ∞ βΩ	1
1 3 6		ו
Expression (MathML Tree) (MathML Text) >	KHTML)	_
Navigation: line - presentation MathML; parent node - [Size: Subscript Style: Other Zoom: 300 %	1/



Enclose Expression Inside Notation

The "menclose" element renders its content inside the enclosing notation specified by its notation attribute. According to the W3C Recommendation (Mathematical Markup Language (MathML) Version 2.0), "the values allowed for notation are open-ended". So, that is a place for handling encoding variants which are not directly specified in MathML 2.0.

MathML Weaver benefits from the "menclose" element by implementing both the proposed by W3C values of the "notation" attribute (longdiv, actuarial, radical, box, roundedbox, circle, left, right, top, bottom, updiagonalstrike, downdiagonalstrike, verticalstrike,

horizontalstrike) and its own values (joint-status, top-left, top-right, bottom-left, bottom-right, box-dashed). There are several toolbars for having "menclose" element, since buttons are grouped according more to their sense than to their MathML equivalent. A user can find "menclose" elements in such toolbars as:

- ✓ fractions and radicals (!!);
- ✓ underbars and overbars (□,);
- ✓ boxes (□).

See the following figures for example of using "menclose" elements. We insert several formulas using "menclose" elements and then via WYSIWYG-style editing on the "MathML Tree" page we change values of the "notation" attribute. Results are shown by switching again on the "Expression" page.



Formulator - [Formul1] Image: Second seco	×
Image: Bile Edit View MathML Window Help	\sim
	<u></u>
📃 📂 🔚 🔏 🗈 🖻 E 🗧 🗮 🎧 🐼 🔎 🍏 🔮	
⊡ math	
Entity name: menclose	_
E-mtr Value	
	_
inotation instation insta	-
actuarial actuarial	
i i bottom	- 11
box, box,	- 11
	- 11
± mi ⊡ mi	- 11
Teft	- 11
	- 11
radical	- 11
right	- 11
notation top	
a kind of rendering of the met upplagonalstrike	
Expression J MathML Tree MathML Text J XHTML	
	//.

🚱 Formulator - [Formul1]	
💁 Eile Edit View Style Size Options Window Help	_ 8 ×
Presentation \times \neq ab \times κ \notin χ β Ω Π (Π) Π_{Π} Π^{Π} Σ^{Π} \int_{Ω} Π Π Π	
$\overline{\mathbf{A}} = \overline{\mathbf{B}} - \sqrt{\mathbf{C}} \overline{\mathbf{D}}$	•
Expression MathML Tree MathML Text XHTML	
Navigation: line - presentation MathML; parent node - Size: Regular Style: Other Zoom: 3	00 % 🔋 //

Tables and Matrices

A matrix or table is specified using the "mtable" element. It can be accessed via 🔢 toolbar:

🚯 Formulator - [Formul1]	
🛃 File Edit View Style Size Options Window	w Help
Presentation	
≠ ab ×÷ < ∉ λ % β	Ω
Expression (MathML Tree) (MathML Text)	
Variable-size table	Size: Nariable-size table : Other Zoom: 200 %

There are 12 buttons for simple cases of a matrix and one button that requests a user to enter the number of rows and columns:

🚮 Formulator - [Formul1]	- 🗆 ×
💇 File Edit View Style Size Options Window Help	_ 뭔 ×
Presentation 🗵	^
$\neq \underline{ab} \stackrel{\times_{+}}{\sim} \not\in \widehat{\lambda} \not \gg \beta \Omega \blacksquare$	
Table	
Rows: 3 🔅 OK Columns: 3 😴 Cancel	
	•
Expression MathML Tree MathML Text XHTML	
Navigation: line - presentation MathML; parent node - Size: Regular Style: Other Zoom: 3	200 % 📔 //,

After inserting of a table or a matrix a user still has a chance to change its appearance via fine tuning of attributes for the "mtable", "mtr" and "mtd" elements. The next example shows how to alter alignments and framing of all the table and of some of its cells.

1. Enter a table and fill it with values.



2. Switch to the "MathML Tree", select "mtable" element on the left side of the document (note that in multiline expressions we don't need the *outer* "mtable" element that is used for encoding several lines as rows of a table). Now the right side indicates current attributes of the "mtable" element.

Click on the right side of the document to give it focus; then press the "Insert" button on the "Property-Value" pane. This will insert a new empty line for the attribute.

🚱 Formulator - [Formul1]			
🙆 Eile Edit <u>V</u> iew <u>M</u> athML <u>W</u> indow <u>H</u> elp			_ 8 ×
mtable ▲	Entity name: mtable	•	•
⊡~mtd ⊡~mn	Property	¥alue	<u> </u>
i⇒ mtd i± · mn i≕ · mtd	rowalign	center	•
in mn ⊡ mtr □ mtd			
Expression MathML Tree MathML Text XHTML			
			11.

3. Click on the blank field of newly added attribute and use the drop list to get the list of all predefined attributes which are proper for the "mtable" element.



4. Select the "columnalign" attribute in the list; then place cursor to the "Value" column of the "Property-Value" pane and use the drop list to get the list of all predefined values which are proper for the "columnalign" attribute. Change the value of the attribute to the value of "right".

🚮 Formulator - [Formul1]			
💁 Eile Edit View MathML Window Help			- B ×
in mtable ▲	Entity name: mtable		•
i in the second	Property	Yalue	
⊡∙mtd	columnalign	I	-
i ⊡ mn — — — — — — — — — — — — — — — — — —	rowalign	center left	
É∵mn	columnalign	right	
mtr in mtd Expression (MathML Tree) (MathML Text) (XHTML)	how wide a column shou	ld be	
			11.

5. See how alignment of the whole table is changed.



6. Using similar operations change alignment individually for the cell (1, 3) of the table.

🚮 Formulator - [Formul1]		<u>_ ×</u>
🙍 Eile Edit View MathML Window Help		_ & ×
È-mtable ⊡-mtr ⊡-mtd ⊡-mtd ⊡-mtd	Entity name: mtd Property columnalign	Value
Expression MathML Tree MathML Text XHTML	columnalign how wide a column should b	center left right



7. Switch to "MathML Tree" to change the frame of the table; switch back to see the results.

🚮 Formulator - [Formul1]		
💁 Eile Edit View MathML Window Help		_ 8 ×
⊡ mtable ⊡ mtr	Entity name: mtab	le 💌
⊡⊶mtd †⊒⊶mn	Property	Value 🔺
⊡mtd	frame	
⊡-mtd	rowalign	dashed
±	columnalign	solid
⊡ mtr ⊡ mtd	frame	
	⊻	

🚮 Formulator - [Formul1]	
File Edit View Style Size Options Window Help	_ 8 ×
Presentation \times \neq ab \times \notin \hat{X} \hat{p} \hat{p} $\hat{\Omega}$ $\hat{\Pi}$ (Π) Π_{Π} Π^{Π} $\hat{\Pi}$ Π^{Π} Π^{Π} Π^{Π} Π^{Π}	<u> </u>
111 2 3 a b ccc	
A BBB C	
Size: Regular Style: Other Zoom:	200 % 📔 🎢

🛃 Formulator - [Formul1]			
🛃 Eile Edit <u>V</u> iew <u>M</u> athML <u>W</u> indow <u>H</u> elp			_ 8 ×
⊡- math ⊡- mtable	-	Entity name: mtable	_
⊡- mtr ⊟- mtd		Property	Yalue 🔺
		rowlines	none solid
⊡-mtext ⊡-mtr		columnlines	dashed solid
i mtd		frame	dashed
i the mtext ⊡- mtr		rowalign	center
i mtd		columnalign	right right left
		rowlines	
	-		
Expression MathML Tree MathML Text XHTM	1L_)		
			11.



Style Change

There are two ways to deal with "mstyle" element and style attributes in Formulator MathML Weaver.

The first way is implicitly changing of style of formula elements by using menu Style and Size.

🚮 Formulator - [Formul1]	
File Edit View Sty Other Style	x _8×
Presentation Font: ≠ ab ×+ ⊾ Bernard MT Condensed Blackadder ITC Bodoni MT Bodoni MT Black Bodoni MT Black Bodoni MT Poster Compressed Bodoni MT Poster Compressed Book Antiqua Bookshelf Symbol 7 Bradley Hand ITC Britannic Bold Britannic Bold T	OK Cancel Italic Bold
Navigation: line - presentation MathML; parent node - Size: Regular	Style: Other Zoom: 200 % P



Then we can switch to the "MathML Tree" page and proceed with editing via WYSIWYG-style actions.

🛃 Formulator - [Formul1]				
🛃 Eile Edit View MathML Window Help				_ 8 ×
i≕mtr i≕mtd	•	Entity name: mi		•
		Property	Value	_
		mathvariant	normal	
⊡ mtd † mtext		fontfamily	Britannic Bold	
		mathcolor	🔄 yellow	-
⊡·mtd ⊡·mi A	-	nathvariant font style	,	
Expression MathML Tree MathML Text XHTN	1L)			

🛃 Formulator - [Formul1]		
💁 File Edit View MathML Window Help		_ B ×
⊡ · math ⊡ · mtable	Entity name: mi	
terrenter terrenterrenter	Property	Yalue
	mathvariant	normal
l ⊡··mtd ⊡··mi	fontfamily	Britannic Bold
	mathcolor	🗖 yellow 🔍
	mathvariant	
	font style	
Expression (MathML Tree) (MathML Text) (XH1		Custom color

Formulator - [Formul1]			
Eile Edit View MathML Window Help			
⊡- math È- mtable	Entity name: mi		•
intr intr intr	Property	Value	_
	mathvariant	normal	
l ⊡•mtd	fontfamily	Britannic Bold	
Α.	mathbackground	📃 lime	
	mathsize	big	•
	mathcolor	big normal	
		small	_
	mathsize		
	font size		
Expression (MathML Tree) (MathML Text) XHT		
			//

🛃 Formulator - [Formul1]									
🙋 E	ile	<u>E</u> dit	⊻iew	<u>S</u> tyle	Si <u>z</u> e	Options	<u>W</u> indow	Help	
							Presenta	ation 🗵	
	١						≠ ą (∷) ¤	Ϸ×+ Ϛ ∉ Ҳ ͽ β Ω Π΄ Δ Π°Σ□ ∫₽ 및 큠 Π□ ▓ □	
								Box temp	
	DE	xpres:	sion) (I	MathML	Tree	MathML	Text XH	TML	
Box te	mpla	ates					Si	ze: Large Symbol Style: Other Zoom: 200 % //	

The second way of style changing is to insert the "mstyle" element on the "MathML Tree" page and to edit it using operations with nodes of the tree. Note that the "mstyle" element is inserted as an empty invisible "mrow" element that carries its own set of attributes.

1. The next example shows how to change alignment of the fraction elements using attributes of the "mstyle" element.

6 Form	ulato	r - [Fo	rmul1]]						_ 🗆	×
🚺 Eile	<u>E</u> dit	<u>V</u> iew	<u>S</u> tyle	Si <u>z</u> e	Options	<u>W</u> indow	Help			_ 8	×
2	22	1	22:	22		Presenta		∉ <u>x</u> % [: <u>I</u> =	β Ω Π= ==================================	× 11	4
Navigatio	n: line	- prese	ntation	MathM	1L: parent	node - Si	ze: Regular	Style: Other	Zoom:	200 %	

🚯 Formulator - [Formul1]		
Eile Edit View MathML Window Help Eile Edit View MathML Window Eile Edit View MathML Eile Eile Edit View MathML Eile Eile Edit View MathML Eile Eile		_ 8 ×
⊡- math ⊡- mstyle	Entity name: mstyle	•
⊡…mfrac †+…mn	Property	Value
	numalign 💌	right
Expression MathML Tree MathML Text XHT	Inethickness Iquote Ispace mathbackground mathcolor mathsize mathvariant maxsize mediummathspace minlabelspacing minsize movablelimits notation r open rowalign rowlines rowspacing	

🚯 Formulator - [Formul1]		
💁 Eile Edit View MathML Window Help		_ & ×
⊡ · math ⊡ · mstyle	Entity name: mstyle	_
⊟ mfrac	Property	Yalue 🔺
	linethickness	thick
	numalign	right
	l numalign	
	numerator alignment	
Expression (MathML Tree) (MathML Text) (XH	[
		1.

Formulator - [Formul1]	
Eile Edit View Style Size Options Window He	هه
1 222222222 22222222	×÷ № ∉ λ % β Ω ∏ □ Σ□ ∫□ ⊒ = Π□ ∷ ⊡
Expression (MathML Tree) (MathML Text) (XHTML)
Size:	Regular Style: Other Zoom: 200 % 🥢

2. The next example shows how to change appearance of token elements by editing attributes, related to a font.



Entity name: mn Property mathbackground	_ ₽ ×
Entity name: mn Property mathbackground	Value
Property mathbackground	Value
mathbackground	— 00-500
	004500
fontfamily	Britannic Bold
Class color fontsize fontstyle fontweight id mathcolor mathsize mathvariant style xlink:href xref	
	fontsize fontstyle fontweight id mathcolor mathsize mathvariant style xlink:href xref

🛃 Formulator - [Formul1]		
🛃 Eile Edit View Style Size Options	<u>W</u> indow <u>H</u> elp	_ 8 ×
	Presentation	
· · · · ·	≠ ₫ *÷ ↖ ∉ λ ∞ β Ω	II
22222222	(II) 1/0 II ⁰ 20 j <u>e</u> 1 ii III	
··		
	Text (XHTML)	
	Size: Regular Style: Other Zoom:	200 % //

Error Message

A user can enter a new tag name on the "MathML Text" page, since it is just a text editor addition to MathML Weaver. This case should be treated as a user error, because the editor don't know how to deal with unknown elements.

In order to get user know about errors Formulator MathML Weaver uses the "merror" element. In the next example a user enters unknown tag name "new-tag" and gets a message about error in MathML 2.0 notation.

🚮 Formulator - [Formul1]	- U ×
🚰 Eile Edit View Window Help	_ 8 ×
<new-tag></new-tag>	
4	Þ
Expression MathML Tree MathML Text XHTML	
	1.

6	Form	ulato	r - [Fo	rmul1]					×
ø	Eile	<u>E</u> dit	⊻iew	<u>S</u> tyle	Si <u>z</u> e	Options	<u>W</u> indow	Help _ E	l ×
							Present	ation 🛛	
							≠ a (::) ¤	b ×+ ⊼ ∉ λ %> β Ω ∏ /a □" Σ= ∫: 및 = Π= № □	
Unexpected tag "new-tag"									
		Expres	sion)	MathML	Tree	MathML	Text XH	TML	
Navi	gatior	n: line	- prese	ntation	MathN	4L; parent	node - Si	ze: Regular Style: Other Zoom: 200 %	_//,