Subject: TrainResistance definition in MathML
Posted by Thomas Albrecht on Tue, 27 Aug 2013 10:17:02 GMT
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Dear colleagues,
we want to exchange rolling stock data for train running simulation in the context of a traffic management system.
Therefore we need a description of the train resistance, the wiki and rolling stock schema say:
http://wiki.railml.org/index.php?title=RS:trainResistance

There are two possibilities to describe the resistance: 1) valueTable or 2)mathml.
ValueTable should be straightforward, but in practice, it seems that rather formulas of the kind
fW = A + C * (V + X) (A, C parameters, V speed of train, X wind speed)
or similar are given, which is probably better formulated using MathML.
There is no documentation so far on the usage of MathML, therefore some questions here for the forum on experiences:

A) Has anyone worked with MathML?
B) Should we use standard symbols and units in order to make it understandable?

Best regards
Thomas Albrecht
TU Dresden
Chair for Traffic Control Systems and Process Automation
tu-dresden.de/vlp

Subject: Re: TrainResistance definition in MathML
Posted by Susanne Wunsch railML on Thu, 29 Aug 2013 12:05:32 GMT
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Hello Thomas,

Thomas Albrecht <Thomas.K.Albrecht@tu-dresden.de> writes:
> or 2)mathml.
> ValueTable should be straightforward, but in practice, it seems that
> rather formulas of the kind
> fW = A + C * (V + X) (A, C parameters, V speed of train, X wind speed)
> or similar are given, which is probably better formulated using MathML.
>
> A) Has anyone worked with MathML?

No experiences from my side.

> B) Should we use standard symbols and units in order to make it
> understandable?

Of course! ;-)

I checked the current MathML standard (version 3.0) and tried to make a proposal for usage in the railML context.

MathML is now widely understood in different tools, but there seems to be great differences between the MathML versions and the degree of implementation completeness.

* Apache OpenOffice4 displays the "Presentation-Mode" if it's separated into a file.
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* LibreOffice4.1 doesn't understand this MathML-version.

I would be interested in further reports about usability of the following MathML code: Mathematica?, MATLAB?, M$ Office?, IE?, Chrome?, Opera? ...

Copy the following lines into a file. Maybe you should snip the MathML part out for testing in MathML-aware tools.

```
?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE math [
  <!ENTITY middot         "&#x000B7;"> <!--MIDDLE DOT -->
  <!ENTITY InvisibleTimes "&#x02062;" ><!--INVISIBLE TIMES -->
]>
<!-- First proposal for definition of formulas inside railML elements
     Following references were used:
     * Mathematical Markup Language (MathML) Version 3.0, Chapter 5 Mixing Markup Languages for Mathematical Expressions,
       W3C Recommendation 21 October 2010: http://www.w3.org/TR/MathML3/chapter5.html#mixing.parallel
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       Open Geospatial Consortium Inc.: http://portal.opengeospatial.org/files/?artifact_id=30575
     * The Unified Code for Units of Measure (UCUM), XML releases of the formal part of the specification,
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     * XML Entity Definitions for Characters, The expanded set of HTML and MathML entity definitions,
       W3C Recommendation 01 April 2010: http://www.w3.org/2003/entities/2007/htmlmathml-f.ent
-->
<railml xmlns="http://www.railml.org/schemas/2013"
```

```
 xmlns:dc="http://purl.org/dc/elements/1.1/"
 xmlns:mml="http://www.w3.org/1998/Math/MathML">
  <rollingstock id="r1">
    <metadata>
      <dc:title>railML rollingstock sample</dc:title>
      <dc:description>Proposal for train resistance definition with a formula</dc:description>
      <dc:creator>Susanne Wunsch</dc:creator>
    </metadata>
    <vehicles>
      <vehicle id="v1"/>
      <vehicle id="v2"/>
    </vehicles>
    <formations>
      <formation id="f1">
        <trainOrder>
          <vehicleRef orderNumber="1" vehicleRef="v1"/>
          <vehicleRef orderNumber="2" vehicleRef="v2" vehicleCount="9"/>
        </trainOrder>
        <trainResistance>
          <mml:math>
            <mml:semantics>
              <!-- Content mathematical expression: 17,456 N + 5,677 Ns/m * v + 1,234 Ns^2/m^2 *
v^2 -->
              <!-- TODO: Currently missing: definition of uom for variable 'v'-->
              <mml:apply>
                <mml:plus/>
                <mml:apply>
                  <mml:times/>
                  <mml:cn type="constant">17,456</mml:cn>
                  <mml:csymbol definitionURL="urn:ogc:def:uom:UCUM::N">N</mml:csymbol>
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                <mml:apply>
                  <mml:times/>
                  <mml:cn href="">5,677</mml:cn>
                  <mml:apply>
                    <mml:times/>
                    <mml:csymbol definitionURL="urn:ogc:def:uom:UCUM::N">N</mml:csymbol>
                    <mml:apply>
                      <mml:divide/>
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                      <mml:csymbol definitionURL="urn:ogc:def:uom:UCUM::m">m</mml:csymbol>
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                </mml:apply>
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                  <mml:times/>
                  <mml:cn type="constant">1,234</mml:cn>
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```
            <mml:apply>
              <mml:times/>
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                <mml:cn>2</mml:cn>
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            </mml:apply>
            <mml:apply>
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              <mml:cn>2</mml:cn>
            </mml:apply>
          </mml:apply>
        </mml:apply>
        <mml:annotation-xml style="MathML-Presentation">
          <!-- Presentation mathematical expression: 17,456 N + 5,677 Ns/m * v + 1,234
Ns^2/m^2 * v^2 -->
          <mml:mrow>
            <mml:mn>17,456</mml:mn>
            <mml:mo rspace='thickmathspace'>&InvisibleTimes;</mml:mo>
            <mml:mi mathvariant='normal' class='MathML-Unit'>N</mml:mi>
            <mml:mo>+</mml:mo>
            <mml:mrow>
              <mml:mn>5,677</mml:mn>
              <mml:mo rspace='thickmathspace'>&InvisibleTimes;</mml:mo>
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              <mml:mo>&InvisibleTimes;</mml:mo>
              <mml:mi>v</mml:mi>
            </mml:mrow>
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            <mml:mrow>
              <mml:mn>1,234</mml:mn>
              <mml:mo rspace='thickmathspace'>&InvisibleTimes;</mml:mo>
              <mml:mrow>
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```

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              </mml:msup>
            </mml:mrow>
          </mml:mrow>
        </mml:annotation-xml>
      </mml:semantics>
    </mml:math>
  </trainResistance>
 </formation>
</formations>
</rollingstock>
</railml>
```

Kind regards...
Susanne

--
Susanne Wunsch
Schema Coordinator: railML.common

Subject: Re: TrainResistance definition in MathML
Posted by Joerg von Lingen on Wed, 11 Sep 2013 17:10:17 GMT
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Hi Thomas,

in 2003 I had already presented some ideas about using MathML bearing in mind that there are quite few forms of polynoms
needed for the purpose.

Best Jörg.

Susanne Wunsch wrote the following on 29.08.2013 14:05:
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>
> Thomas Albrecht <Thomas.K.Albrecht@tu-dresden.de> writes:
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>  -->
>  <railml xmlns="http://www.railml.org/schemas/2013"
>   xmlns:dc="http://purl.org/dc/elements/1.1/"
>   xmlns:mml="http://www.w3.org/1998/Math/MathML">
>    <rollingstock id="r1">
>      <metadata>
>        <dc:title>railML rollingstock sample</dc:title>
>        <dc:description>Proposal for train resistance definition with a formula</dc:description>
>        <dc:creator>Susanne Wunsch</dc:creator>
>      </metadata>
>      <vehicles>
>        <vehicle id="v1"/>
>        <vehicle id="v2"/>
>      </vehicles>
>      <formations>
>        <formation id="f1">
>          <trainOrder>
>            <vehicleRef orderNumber="1" vehicleRef="v1"/>
>            <vehicleRef orderNumber="2" vehicleRef="v2" vehicleCount="9"/>
>          </trainOrder>
>          <trainResistance>
>            <mml:math>
>              <mml:semantics>
>                <!-- Content mathematical expression: 17,456 N + 5,677 Ns/m * v + 1,234 Ns^2/m^2 *
v^2 -->
>                <!-- TODO: Currently missing: definition of uom for variable 'v'-->
>                <mml:apply>
>                  <mml:plus/>
>                  <mml:apply>
>                    <mml:times/>
>                    <mml:cn type="constant">17,456</mml:cn>
>                    <mml:csymbol definitionURL="urn:ogc:def:uom:UCUM::N">N</mml:csymbol>
>                  </mml:apply>
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```

```
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>                     <mml:csymbol definitionURL="urn:ogc:def:uom:UCUM::s">s</mml:csymbol>
>                     <mml:csymbol definitionURL="urn:ogc:def:uom:UCUM::m">m</mml:csymbol>
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>                     <mml:apply>
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>                 <mml:apply>
>                   <mml:power/>
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>                   <mml:cn>2</mml:cn>
>                 </mml:apply>
>               </mml:apply>
>             </mml:apply>
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>               <!-- Presentation mathematical expression: 17,456 N + 5,677 Ns/m * v + 1,234
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>                     <mml:mn>5,677</mml:mn>
>                     <mml:mo rspace='thickmathspace'>&InvisibleTimes;</mml:mo>
>                     <mml:mrow>
```

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>                 <mml:mi mathvariant='normal' class='MathML-Unit'>N</mml:mi>
>                 <mml:mo>&middot;</mml:mo>
>                 <mml:mfrac>
>                   <mml:mi mathvariant='normal' class='MathML-Unit'>s</mml:mi>
>                   <mml:mi mathvariant='normal' class='MathML-Unit'>m</mml:mi>
>                 </mml:mfrac>
>               </mml:mrow>
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>                   <mml:msup>
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>                   </mml:msup>
>                 </mml:mfrac>
>               </mml:mrow>
>               <mml:mo>&InvisibleTimes;</mml:mo>
>               <mml:msup>
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>                 <mml:mn>2</mml:mn>
>               </mml:msup>
>             </mml:mrow>
>           </mml:mrow>
>         </mml:annotation-xml>
>       </mml:semantics>
>     </mml:math>
>   </trainResistance>
>  </formation>
> </formations>
> </rollingstock>
> </railml>
>
> Kind regards...
> Susanne
>
```

File Attachments
1) MathML-RailML-030924.pdf, downloaded 722 times

Subject: Re: TrainResistance definition in MathML
Posted by Thomas Albrecht on Thu, 12 Sep 2013 08:37:52 GMT
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Hi Joerg and Susanne,
Thanks for your replies.
We still need to describe:
- which symbol is used for which physical quantity
- which units of measurements are used for which variable (these might vary significantly e.g. for speed from m/s, km/h to mph)

Can that be done in MathML or within railML?

The "MathML semantic layer" looks like a good way to represent the formulas. However, if we exchange data in that way between different tools, every tool must do some MathML parsing and interpretation of the nested structure of the formulas. That might be time-critical for some real-time applications.

Still hope that someone has actually used this in practice for data exchange and can contribute to that forum ...

Thomas

Am 11.09.2013 19:10, schrieb Joerg von Lingen:
> Hi Thomas,
>
> in 2003 I had already presented some ideas about using MathML bearing in mind that there are quite few forms of polynoms
> needed for the purpose.
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>>     <rollingstock id="r1">
>>       <metadata>
>>         <dc:title>railML rollingstock sample</dc:title>
>>         <dc:description>Proposal for train resistance definition with a formula</dc:description>
>>         <dc:creator>Susanne Wunsch</dc:creator>
>>       </metadata>
>>       <vehicles>
>>         <vehicle id="v1"/>
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>>       </vehicles>
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>>         <formation id="f1">
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>>             <vehicleRef orderNumber="1" vehicleRef="v1"/>
>>             <vehicleRef orderNumber="2" vehicleRef="v2" vehicleCount="9"/>
>>           </trainOrder>
>>           <trainResistance>
>>             <mml:math>
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>>                 <!-- Content mathematical expression: 17,456 N + 5,677 Ns/m * v + 1,234 Ns^2/m^2
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>>                 <!-- TODO: Currently missing: definition of uom for variable 'v'-->
>>                 <mml:apply>
>>                   <mml:plus/>
>>                   <mml:apply>
>>                     <mml:times/>
>>                     <mml:cn type="constant">17,456</mml:cn>
>>                     <mml:csymbol definitionURL="urn:ogc:def:uom:UCUM::N">N</mml:csymbol>
>>                   </mml:apply>
>>                   <mml:apply>
>>                     <mml:times/>
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```

```
>>                 </mml:apply>
>>                </mml:apply>
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>>                <mml:cn type="constant">1,234</mml:cn>
>>                <mml:apply>
>>                 <mml:times/>
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>>                  <mml:mn>5,677</mml:mn>
>>                  <mml:mo rspace='thickmathspace'>&InvisibleTimes;</mml:mo>
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```

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>>
>> Kind regards...
>> Susanne
>>
```