TUG2003, Enabling Web-access to a Database of Calculus Problems Using LaTeX, PHP and LaTeX2HTML

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- Discuss feedbacks what we have got from students and teachers from this new environment

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- search options

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We wanted to use a database in order to provide students with tools for performing searches on the calculus information.

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Base LaTeX-files, articles and exercises include categorization which defines the final destination of the file in our Web-environment. Categorization is done in the following way and order:

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- The name of the file `\tunniste{}`, for example

  `\tunniste{lta179}`. Comes from the words Liisa, Torikka, article and the number of the article.
- The highest categorization in our content dictionary `\alue{}`, for example `\alue{taydy}`

which means ordinary differential equation.

- Next categorization area is a section `\luku{}`, for example `\luku{2kdy}`, means second order differential equations.
- Then comes lowest categorization area which is a chapter `\kappale{}`, for example `\kappale {vali}`, means constant coefficient linear.
- Then comes the name of the file `\otsikko{}`, for example `\otsikko{Toisen kertaluvun vakiokertoimiset}`,
  means second order constant coefficient linear ODE.
- Then come two arguments which characterize the file `\luonne[]{}` for example `\luonne [Matlab]{teoria}`, here the first argument

Matlab is to address that you need a computer program called Matlab to run the issued theory part, the second argument teoria means theory.

- A short description of what the file includes `\kuvaus{}`.
- Name of person who has typed the file issued for example `\tekija{Liisa Torikka}`.
- Date `\pvm{29.8.2002}`.
- Language `\kieli{}` Finnish is the default.
- Original source `\lahde{LTKK/Pekka Jauhon moniste, kevät 2002}`.
- Copyrights `\kayttooikeus{}`.
- Source code, for example `\lahdekoodi{LaTeX}`

- Level of the material's first argument and the institution name, for example `\laitos[mathematics] {LUT}`.
- Then come the keys which are to help database searches for example `\avain[Calculus] {course}`, normally we use many keys to make files easy to find from our database.
- After these definitions comes the actual article or exercise.

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After we have a functioning LaTeX-file let us say a file called `abc.tex` we will run a script that uses the LaTeX2HTML translator. The script is done in PERL and it transfers when executed the original LaTeX-file into the package of files called `abc.tar.gz` which includes original file `abc.tex` in pieces of converted HTML files.

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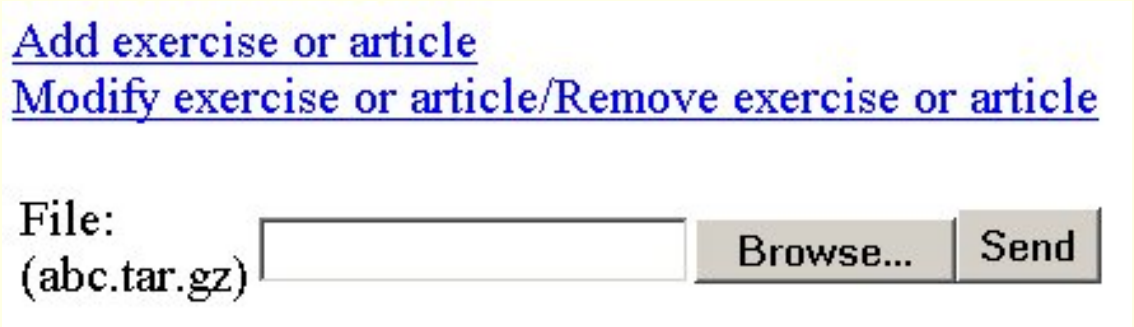

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- it will be unpacked,
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- HTML-pages will be sent to the right directory

All this is done based on the information included into the original LaTeX-file.

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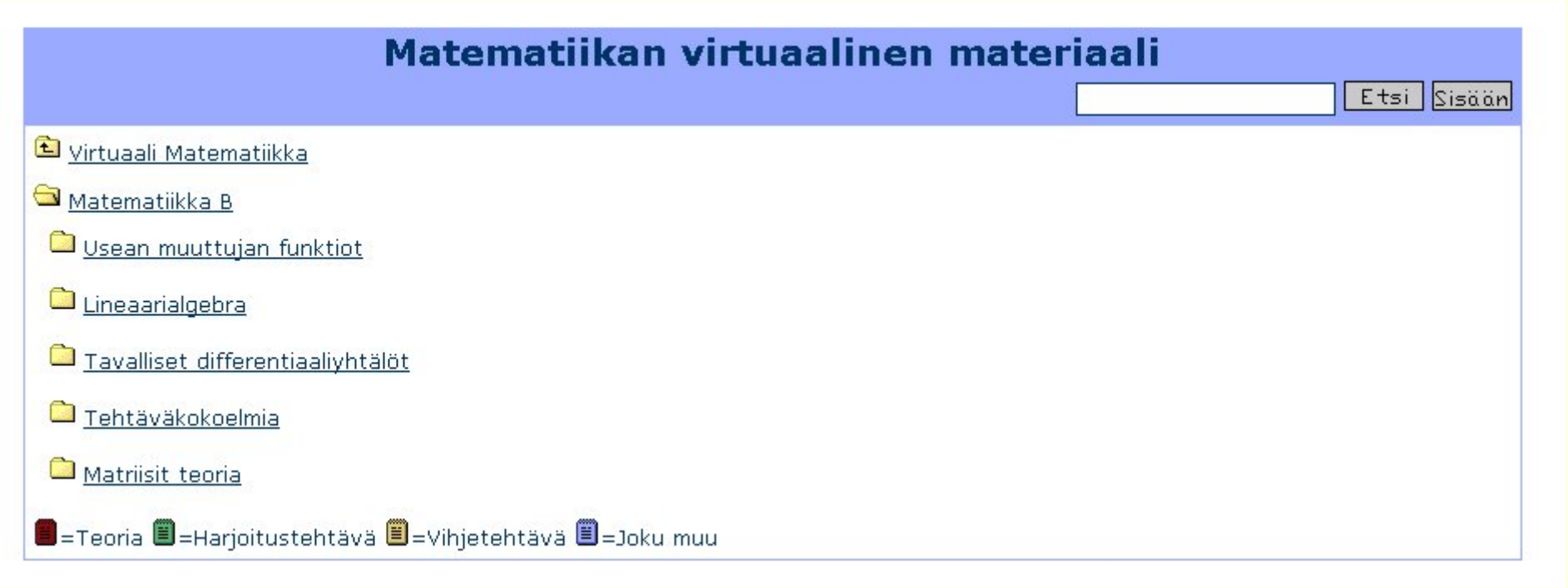

Example

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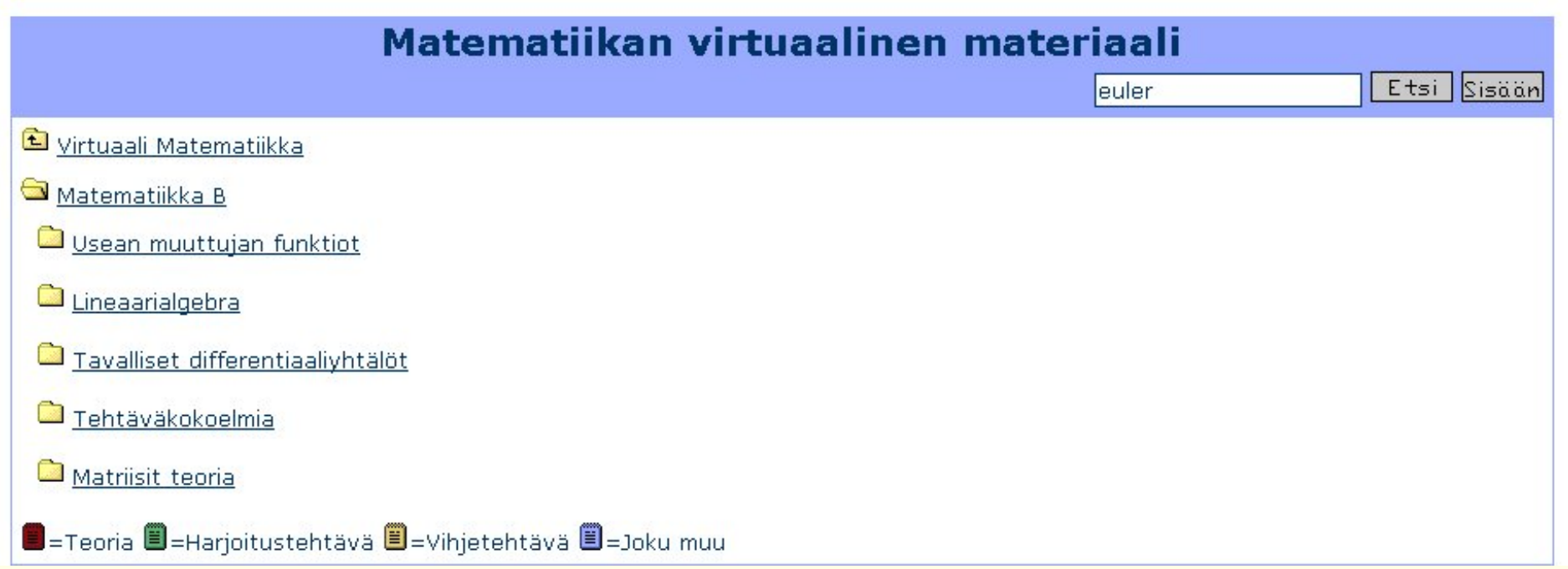

and the outcome of the search lookslike figure below.

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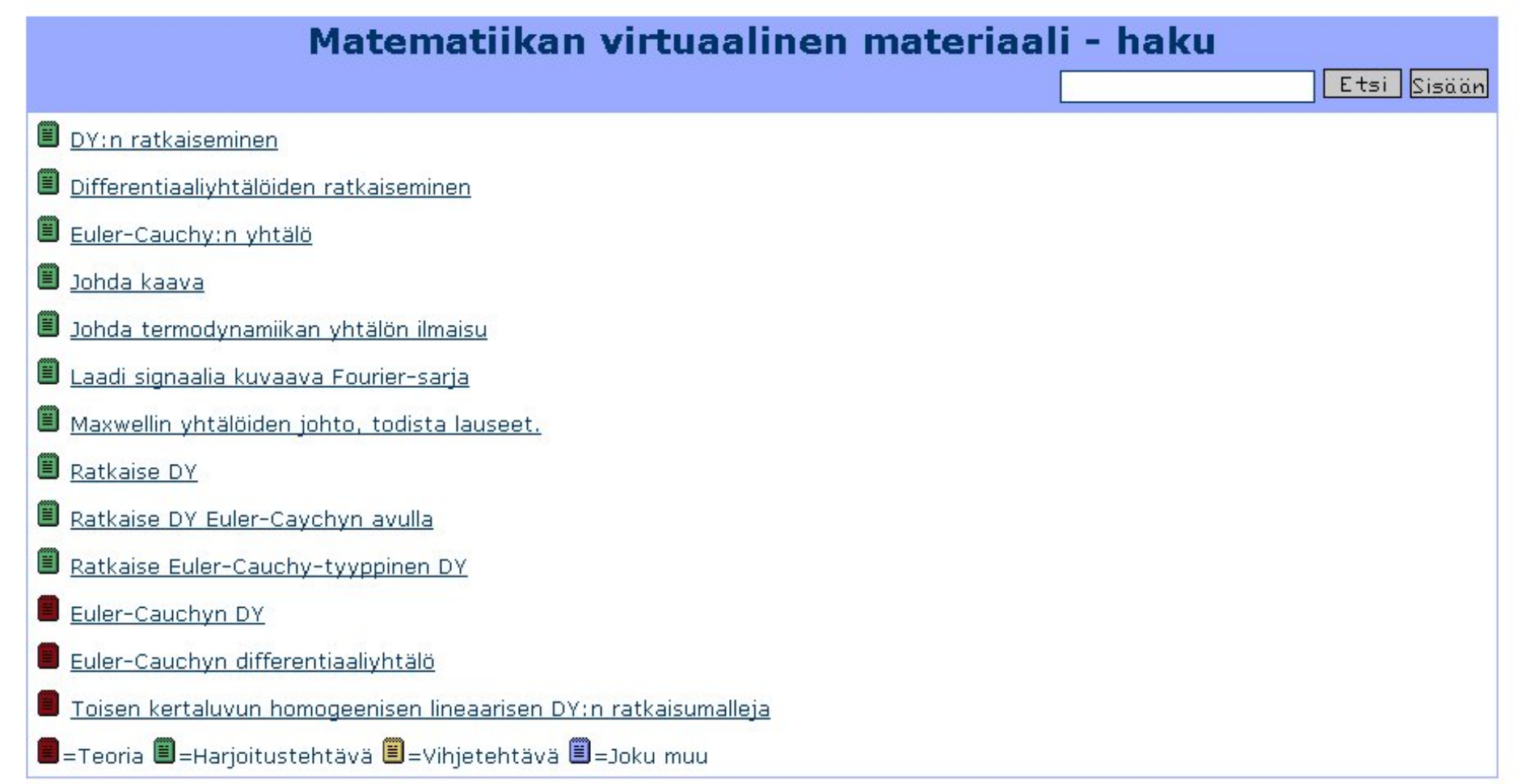

This works well, at least if one knows the appropriate term for what one is looking for.

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Matematiikan virtuaalinen materiaali

Teoria: Euler-Cauchyn DY

Etsi Sisään

Huomaa: Euler-Cauchyn DY toisen kertaluvun differentiaaliyhtälöille voidaan laskea n:nnen kertaluvun DY:lle sijoittamalla yhtälöön

$$x^n y^{(n)}(x) + p_1 x^{n-1} y^{(n-1)}(x) + \ldots + p_{n-1} x y'(x) + p_n y(x) = 0 \qquad (1)$$

$y(x) = x^m$.

Esimerkki: Kolmannen kertaluvun Euler-Cauchy differentiaaliyhtälön

$$x^3 y'''(x) + p_1 x^2 y''(x) + p_2 x y'(x) + p_3 y(x) = 0 \qquad (2)$$

ratkaisuksi saadaan sijoittamalla $y(x) = x^m$ seuraavaa: $x^m\left(m(m-1)(m-2) + p_1 m(m-1) + p_2 m + p_3\right) = 0$, koska $x^m = 0$ vain arvolla $x = 0$ voidaan se jättää huomiotta, eli saadaan yhtälö

$$m(m-1)(m-2) + p_1 m(m-1) + p_2 m + p_3 = 0 \Leftrightarrow$$

$$m^3 + (p_1 - 3)m^2 + (p_2 - p_1 + 2)m + p_3 = 0, \qquad (3)$$

josta ratkaisemalla juuret saadaan kantaratkaisut samaan tapaan kuin edellä.

Conclusions and future

We have gotten a lot of positive and a very few negative comments from these pages that we have created. Our pages have been used in our normal basic courses and both lecturers and students have taken them as their own. We have also done both qualitative and quantitative usability testings for these pages and the results have been very promising.

In the future, we are for example, going to automatize the way the text will be caught into the paper in for example examinations. This will make usability in our pages better if one thinks for example of distance education. We will also continue developing these pagesa lot of animations, etc. are going to be a part of these pages in near future.