Individualised Approaches in Control Education Courses with Large Number of Students

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Contents

Automatic Control Fundamentals

- 26 hours of lectures
- 26 hours of computer labs
- 250 students
- 2001 – the 3rd most negative in the students ranking
- 2006 – the 5th most positive in the students ranking
- self-learning package

Components of Internet Suite

- study materials, presentations, files for download, information about the course,
- basic operations using MWS (polynomials, matrices, pzmap, step),
- Internet version of all course topic problems,
- on-line tests and preparation for written tests,
- Moodle e-learning portal for gradebooks, attendances, quizzes, etc.
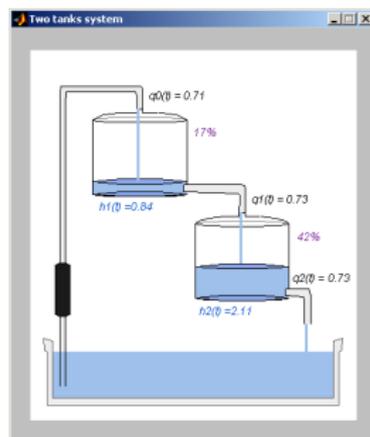
`http://www.kirp.chtf.stuba.sk/lcza` (in Slovak).

`http://www.kirp.chtf.stuba.sk/moodle` (in Slovak).

Contents of Exercises

- differential equations
- transfer function algebra
- step responses
- poles and zeros
- modelling of chemical processes
- closed-loop stability
- PID controller design
- process control

E-learning

1. General part: Open Source LMS Moodle (unique assignments, discussions, gradebook, etc)
2. Scientific part: generation of individual tests, assignments

Contents

Assignment Module

MATLAB scripts $\rightarrow$ HTML files

1. random input values for one student
2. solution and intermediary results for one student
3. A script to gather 1, 2 for all students
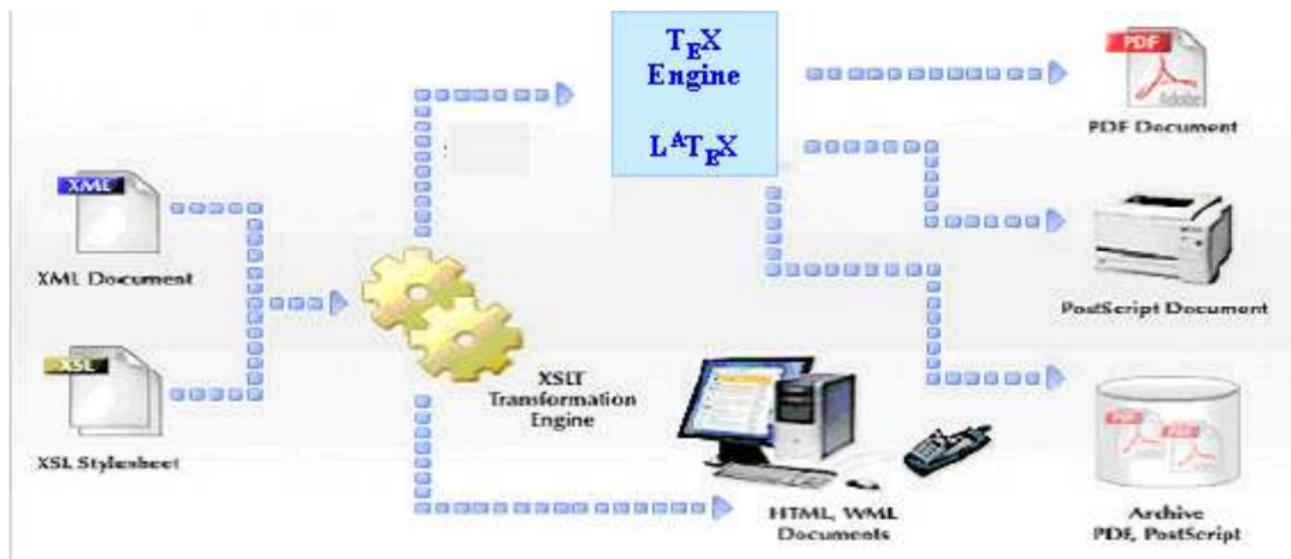4. A script to generate HTML files for students and teachers

Contents

Generation of Tests

1. MATLAB
2. XML File
3. XSLT Transformation
   1. LaTeXproduces PDF
   2. XHTML for www
   3. LMS format for Moodle

Generation of Tests /2

Problem and Solution

The closed loop system consists of a controlled system with transfer function of the form $G(s) = \frac{b_0}{s^2 + a_1 s + a_0}$ and a PID controller of the form $G_c(s) = P + I/s + Ds$. If the setpoint value is changed at $t = 0$ from 0 to w, the permanent tracking error is given as:

$$e(\infty) = \begin{cases} w\left(1 - \frac{b_0 P}{a_0 + b_0 P}\right) & \text{if } I = 0 \\ 0 & \text{otherwise} \end{cases}$$

MATLAB Computational Engine

XML File

PDF Output

L#T#X produces versions both for students . . .

Problem 1. The closed loop system consists of a controlled system with transfer function of the form $G(s) = \frac{3}{s^2+5s+7}$ and a controller of the form $G_c(s) = 9 + 5s$. If the setpoint value is changed at t=0 from 0 to 10, the permanent tracking error is given as

> 3

- ◯ 2.06
- ◯ -1.15
- ◯ 0.13
- ◯ 0.29
- ◯ no other choice is correct

PDF Output

LaTeX produces versions both for students and for teachers

Problem 1. The closed loop system consists of a controlled system with transfer function of the form $G(s) = \frac{3}{s^2+5s+7}$ and a controller of the form $G_c(s) = 9 + 5s$. If the setpoint value is changed at t=0 from 0 to 10, the permanent tracking error is given as

$$\boxed{3}$$

    $\sqrt{}$ 2.06

    ◯ -1.15

    ◯ 0.13

    ◯ 0.29

    ◯ no other choice is correct

S T U

XHTML + JavaScript Output

Problem 1 .) The closed loop system consists of a controlled system with transfer function of the form $G(s) = \frac{3}{s^2 + 5s + 7}$ and a controller of the form $G_c(s) = 9 + 5s$. If the setpoint value is changed at t=0 from 0 to 10, the permanent tracking error is given as

3

○ no other choice is correct

○ 0.29

○ -1.15

⊙ 2.06

○ 0.13

[Aplikácia JavaScriptu] ✕

⚠ Correct

| OK |

S T U

WebCT/Moodle Output

The closed loop system consists of a controlled system with transfer function of the form $G(s) = \frac{3}{s^2 + 5s + 7}$ and a controller of the form $G_c(s) = 9 + 5s$. If the setpoint value is changed at t=0 from 0 to 10, the permanent tracking error is given as

Answer:
- a. 0.29
- b. 0.13
- c. 2.06
- d. no other choice is correct
- e. -1.15

Correct

Conclusions

- Heavy use of ICT in Education improves ranking of the course
- Individual problems for students
- Reduction (removal) of manual and repetitive tasks
- Productivity increase
- Significant amount of time and work needed to develop the course