Internet accessible Delta Adaptive Toolbox.

Abstract: The developed Delta Adaptive Toolbox is accessible via WWW interface. This application demonstrates properties of delta adaptive controllers and recursive least square methods. The MATLAB[R] Web Server enables to create MATLAB applications that use the capabilities of the World Wide Web to send data to MATLAB for computation and to display the results in a Web browser. MATLAB Web Server application is a combination of M files, Hypertext Mark-up Language (HTML), and graphics.

Key words: Delta model, Adaptive Control, WWW

1. INTRODUCTION

MATLAB[R] is a high-performance program for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

The MATLAB[R] Web Server (MWS) enables you to create MATLAB applications that use the capabilities of the World Wide Web to send data to MATLAB for computation and to display the results in a Web browser. The MATLAB Web Server depends upon TCP/IP networking for transmission of data between the client system and MATLAB. In the used configuration, a Web browser runs on client workstation, while MATLAB, the MATLABWeb Server (matlabserver), and the Web server run on internet server.

To submit input to and receive output from the MATLAB Web Server is necessary browser. The Web server software must be capable of running Common Gateway Interface (CGI) programs.

The application development process for MATLAB[R] Web Server requires a small number of simple steps (MathWorks, 2001):

1. Create the HTML documents for collection of the input data from users and display of output. It can be used a text editor to input HTML directly, or it can be used one of the commercially available HTML authoring systems.

2. List the application name and associated configuration data in the configuration file matweb.conf.

3. Write a MATLAB m-file that:

* Receives the data entered in the HTML input form.

* Analyzes the data and generates any requested graphics.

* Places the output data into a MATLAB structure.

* Calls htmlrep to place the output data into an HTML output document template. The maximum amount of HTML received data from MATLAB is 256 kB.

2. ADAPTIVE DELTA TOOLBOX VIA THE INTERNET

On the first page of the Adaptive Delta Toolbox (Fig. 1.) is possible to set-up sampling period, controlled system, type of the controller, type of the identification and behaviour of the simulation.

[FIGURE 1 OMITTED]

The first is sampling period. The influence of the sampling period on adaptive control with Delta models is not so big as influence on Z-models. As Delta models converge to continuous models with decreasing sampling period, it is more suitable selection of small values. Extremely small sampling period can cause problems with identification if any noise is included in the signal (this is valid especially for real plants). Next problem with extremely small sampling period: It extends duration time of calculation and it is necessary high performance computer.

This version of the Delta Adaptive Toolbox allows only simulating of second order system. This is possible set-up gain and denominator.

There is possible choose type of the controller in the combo box. There are about ten controllers accessible (Fig. 2.). These controllers use three different types of the closed control loop (Fig. 4., Fig. 5., Fig. 6.). Each of these controllers is closely described in (Sysel, 2001) together with three types of identification, which are available in the second combo box (Fig. 3.). All the types of the identifications are modification of the delta recursive least square method because basic least square method is not suitable for real applications.

[FIGURE 2 OMITTED]

[FIGURE 3 OMITTED]

[FIGURE 4 OMITTED]

[FIGURE 5 OMITTED]

[FIGURE 6 OMITTED]

The section "Duration of simulation process" describes desired value. It is possible set-up time length of desired value of step impulse. This version of Adaptive Delta Toolbox allows just only three changes.

The submit button send entered data to the second page (Fig. 7.), where it is possible to set-up starting conditions of recursive identification and important parameters of the controller. There is possible change minimal and maximal value of controller output (saturation) too.

The submit button send all entered data to the Matlab for the computing process (see paragraph 1.). Final result is firstly shown on the small preview which is possible extend to the full size picture (Fig. 8). where bold line is system output, normal line is controller output and dashed line is reference value. Calculation takes a lot of times, it depends on duration of simulation process and on the performance of server hardware.

[FIGURE 7 OMITTED]

[FIGURE 8 OMITTED]

3. CONCLUSION

The developed Delta Adaptive Toolbox consists of six discrete-time delta controllers and four continuous-time self-tuning controllers (with combination of Delta identification allow hybrid adaptive control) and three modifications of the recursive

least square delta identification. Functionality of the developed Delta Adaptive Toolbox is presented in the very simple example. The developed Delta Adaptive Toolbox enables more possibilities for running and testing delta models via Internet. The toolbox provides a pleasant user-friendly interface where each parameter can be selected via the communication menu. No previous experience with the MATLAB system is required to use the program since its unit construction makes it fully accessible. It permits other functions to be added as well as allowing the selection of individual m-files to be used in other programs. The big importance is to e-learning where students can run own examples without ownership of license MATLAB.

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