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COMPUTER AIDED EDUCATION IN AREA OF AUTOMATIC CONTROL - CAAC INFORMATION SYSTEM

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Abstract: *This paper is deals with a presentation of the CAAC (Computer Aided Automatic Control) information system. This information system has a modular structure and it is open so that it is possible to add and eventually modify particular parts of the CAAC information system easy according to personal requirements and pre-defined rules. The CAAC information system has been arranged for the time being into 15 problem areas, the so called subsystems which include the automatic control theory. In all subsystems, the so called "problem specification" is formulated by means of tree structure. The tree structure serves as a basis for the creation of structure of given subsystem on webpages. The usage of the information system is anticipated mainly for didactic purposes whereas utilisation of webpages on the Internet is supposed.*

Key words: *automatic control, dynamic webpages, education, Internet*

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1. Introduction

When solving the particular design of automatic control of the technological process, it is necessary to use some of the methods of analysis of controlled systems, or their identification, synthesis of control loops, solution of robustness of the designed control systems, or adaptive algorithms, design of optimum algorithms for control, simulation of behaviour of the controlled system, including control processes, or predication of time series and predictive control, with an aim at improving quality of the course of the control processes, simultaneously providing safety at technological processes, their economy and influence on the environment. The described CAAC information system represents a continuously created information system of partial problem areas which include the automatic control (Balate et al. 1996; Navratil, 2004). This information system is a certain form of eLearning.

2. CAAC information system

2.1 Conception of the CAAC information system

The CAAC information system structure is open, with a possibility to formulate further problem areas in the area automatic control. The CAAC information system has been arranged for the time being into 15 subsystems (see Fig. 1) (Navratil, 2004).
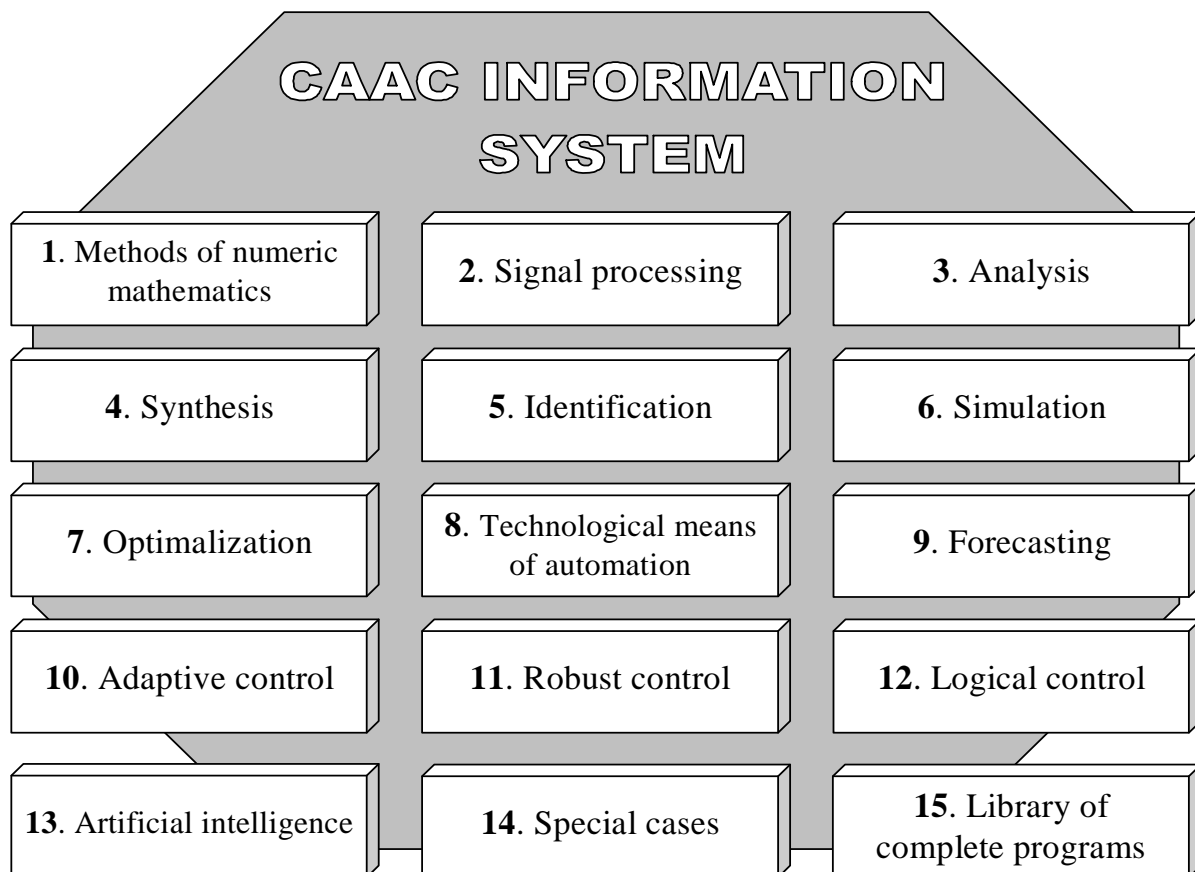

Fig. 1. Problem areas of the CAAC information system

2.2 Structure of the CAAC information system

In all subsystems, the so-called "problem specification" is formulated. Each subsystem is split up into the modules, which are further split up into the sub-modules up into the basic sub- modules, which is the lowest level of hierarchic arrangement of the CAAC information system (see Fig. 2).

The basic sub-module solves the concrete problem (e.g. system stability according to the Lyapunov theory) of the given subsystem (e.g. Analysis - see Fig. 3) and should include description of solving of the problem, example, references and computer program.

An exception is the subsystem „Library of complete programs" (see Fig. 5), where the basic sub-module should include a computer program created for a chosen parts of the concrete subsystem or subsystems and also description of this program (Navratil, 2004).
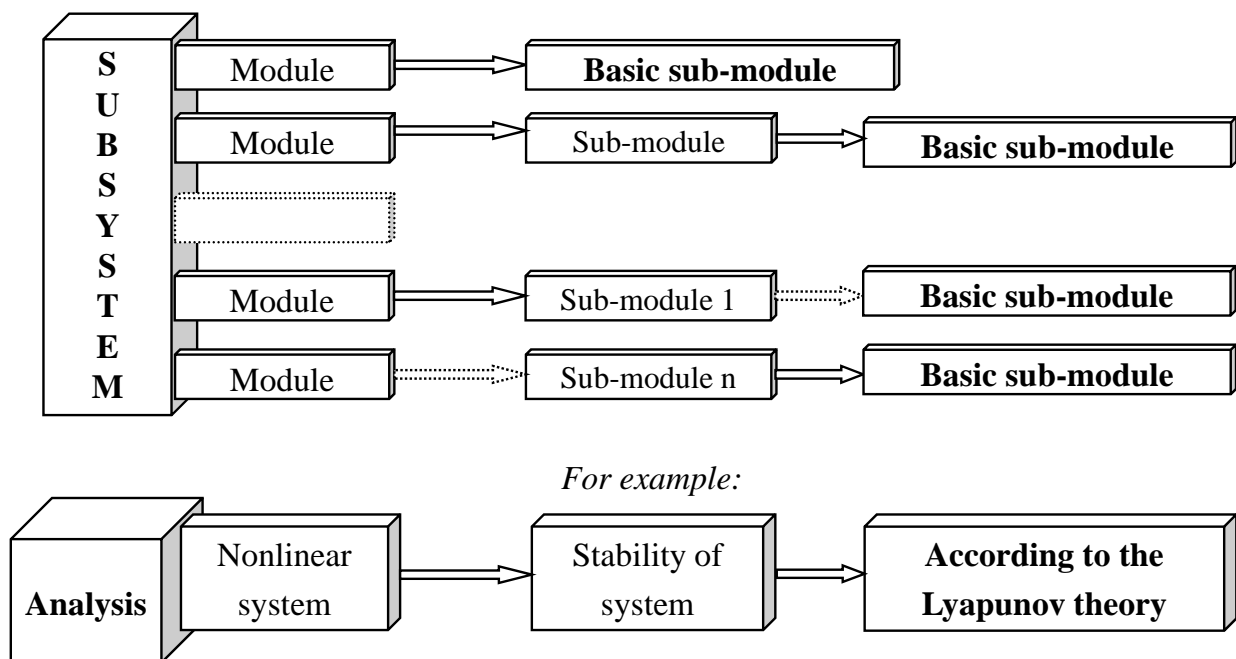

Fig. 2. Structure of the CAAC information system

As shown on Fig. 2, already the third level of the given subsystem may become a basic sub-module. For the reason of easier orientation in particular subsystems of CAAC information system, six levels were stated as the maximum number of levels of each subsystem.

The CAAC information system represents a continuously created, open and modular information system with a possibility to add and eventually modify particular parts of the CAAC information system easy according to personal requirements and pre-defined rules. Special attention was paid to re-processing of tree structure in the CAAC information system, especially in individual, topic-

focused subsystems. Some subsystems appeared part-wise in formerly written theses and then were updated, always in accordance with the latest information.

2.3 Tree structures of subsystems of the CAAC information system

Tree structures of all subsystems serve as a basis for the creation of webpages. They correspond to the structure that is shown in Fig. 2. Tree structures of the chosen CAAC information system subsystems are shown as an example on Fig. 3, Fig. 4. Other examples of tree structures are possible to find in (Navratil, 2004).
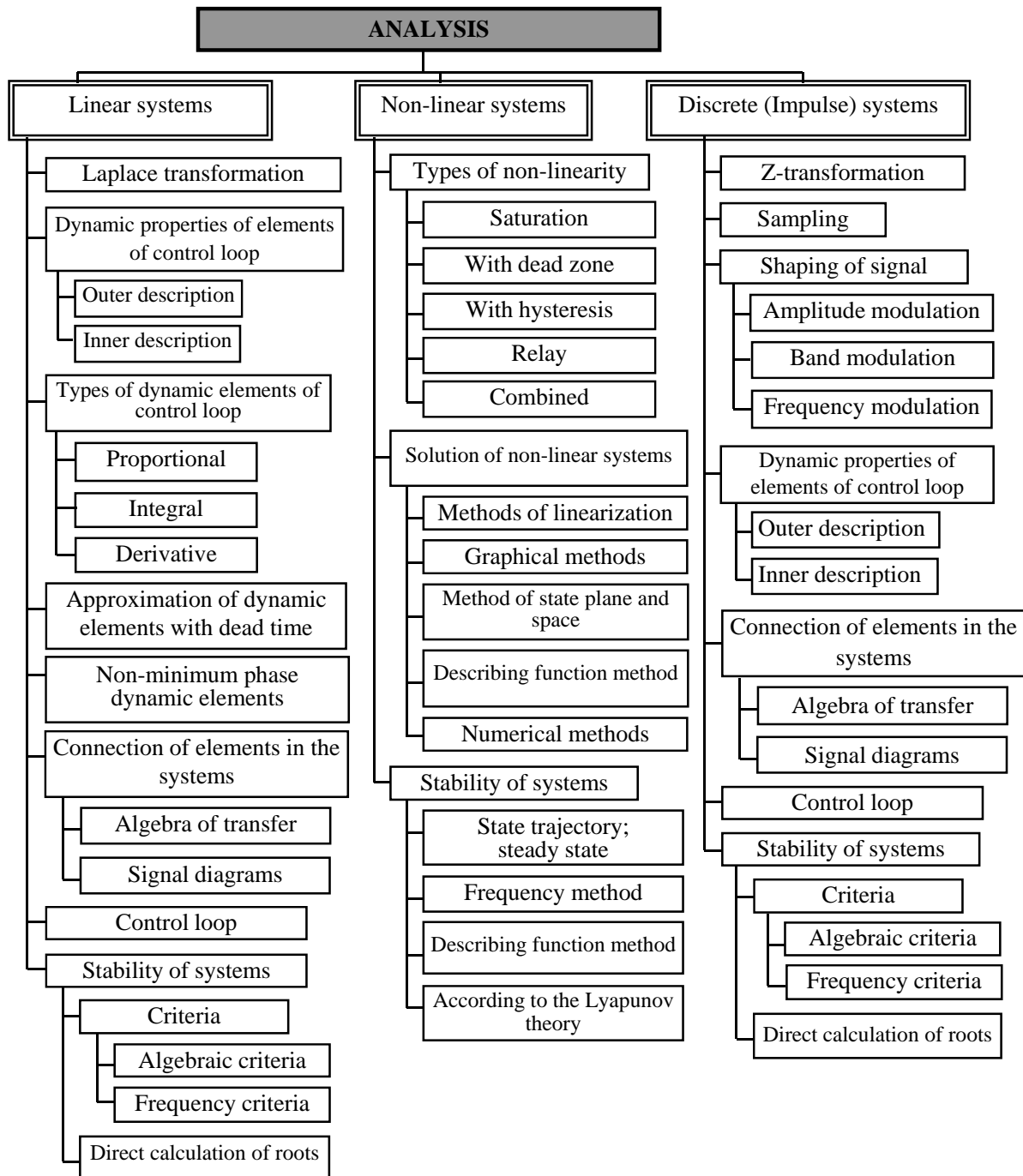
Fig. 3. Tree structure of analysis subsystem

The following figure shows the tree structure of the subsystem „Library of complete programs". This subsystem is divided into two program areas, i.e. single-area and multi-area programs. In single-area programs, problems are solved within one problem area (e.g. in the area analysis *or* synthesis). In multi-area programs, unlike the single-area programs, the defined problems are solved within several problem areas (e.g. analysis *and* synthesis).
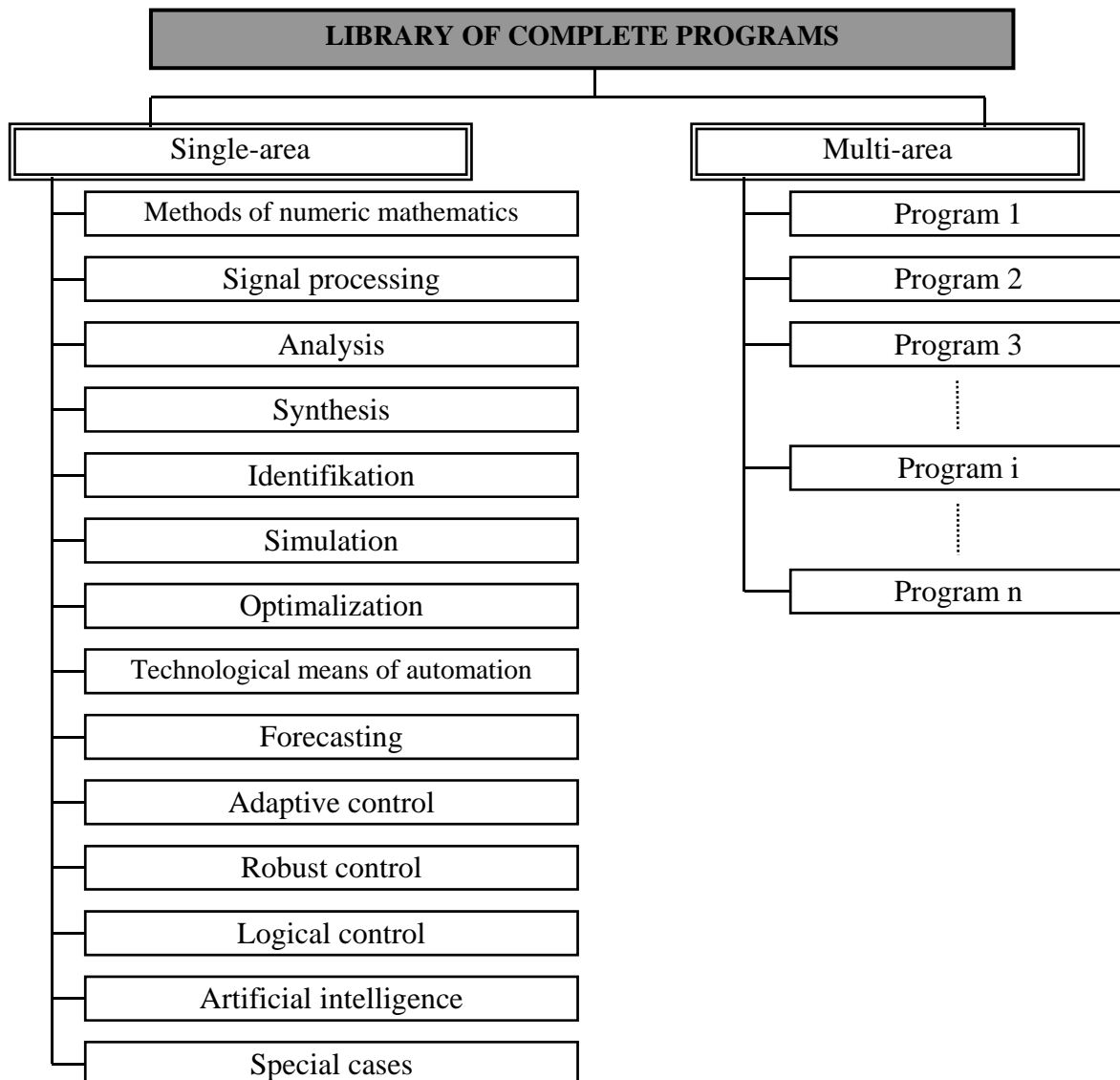

Fig. 4. Tree structure of library of complete programs

3. CAAC information system on webpages

The CAAC information system is very extensive it consists of a large quantity of the individual basic sub-modules which determine due to their contents the quality of the whole CAAC information system. Therefore it was very important to determine such claims in order that it may be possible to complete the CAAC information system with the new basic sub-modules, or as the case may arise, to modify the existing basic sub-modules easily and quickly.

Therefore the following claims are posed on the CAAC information system on WWW pages

- hierarchical arrangement and intuitive names of individual directories and files
- unambiguous structure of a particular webpages of the CAAC information system
- safety at updating and adding of individual parts of this information system
- fast searching of files for their updating

One of possible approaches is the creation of the directories structures and a proposal of the files location in the CAAC information system, the creation of the contents of webpages for individual parts of CAAC information system and the creation of the information lists about the present state of the particular parts of the CAAC information system solution (Navratil, 2004).

To creation of the CAAC information system have used possibilities of PHP language, structured query language (SQL), HTML and cascade style sheets (CSS) (Vesely, 2006; Vesely, 2008).

3.1 Structure of directories and files location in the CAAC information system

For correct and safe adjustment or replacement of one of the files of the CAAC information system, it is necessary to keep a certain location and names of the directories and files. Therefore, they were created 3 types of the directories structures and proposed the files location in these directories. These 3 types cover the whole problem of layout of directories and files in the CAAC information system on webpages. The first structure deals with the most fundamental arrangement of the directories and files in the CAAC information system. The other two structures refer to location of the files inside individual subsystems of the CAAC information system (Navratil, 2004).

3.2 Contents of webpages

Each contents of webpage includes a certain part of the structure of the CAAC information system, which was shown in Fig. 2, where each subsystem is split up into the modules, which are further split up into the sub-modules up into the basic sub-modules. There have been created 3 contents of webpages, i.e. contents of webpages of the subsystem, contents of the information webpage of the subsystem "Library of complete programs" and contents of webpage of the basic sub-module (Navratil, 2004).

3.3 Information lists about the situation of the particular parts of the CAAC information system solution

For better orientation in items of information on status of individual solved parts of the CAAC information system, it was necessary to create a structure of lists of this information system. With help of these lists it could be better to search for information on actual status of particular problems, and on the basis of information gained like this, modifications in this information system might be done. Two

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principal types of the information lists have been created. The first type of the list will comprise information on basic sub-modules of the particular subsystem. This list will be used for subsystems 1 to 14. For subsystem 15, i.e. the subsystem „Library of complete programs", the second type of the list has been created, as not so much information is required for this one (Navratil, 2004).

4. Usage

The use of the CAAC information system is anticipated mainly for didactic purposes whereas utilisation of webpages on the Internet is supposed. Concrete problems of given problem areas - subsystems 1-14 (see Fig. 1) will be described in basic sub-modules in detail. The finished programs that will solve problems in the given problem area or areas will be loaded in subsystem 15 - "Library of complete programs" (see Fig. 1). Last figure (see Fig. 5) shows the way of loading of information into the CAAC information system. The solved task will pass through the evaluation on basis of which the solved task will be recommended or not recommended to be included into the CAAC information system. In case of positive assessment of the solved task, this will be made available to the users by means of the service of webpages. The users will be able to give their comments, based on their experience, to the solution through the author (Navratil, 2004).
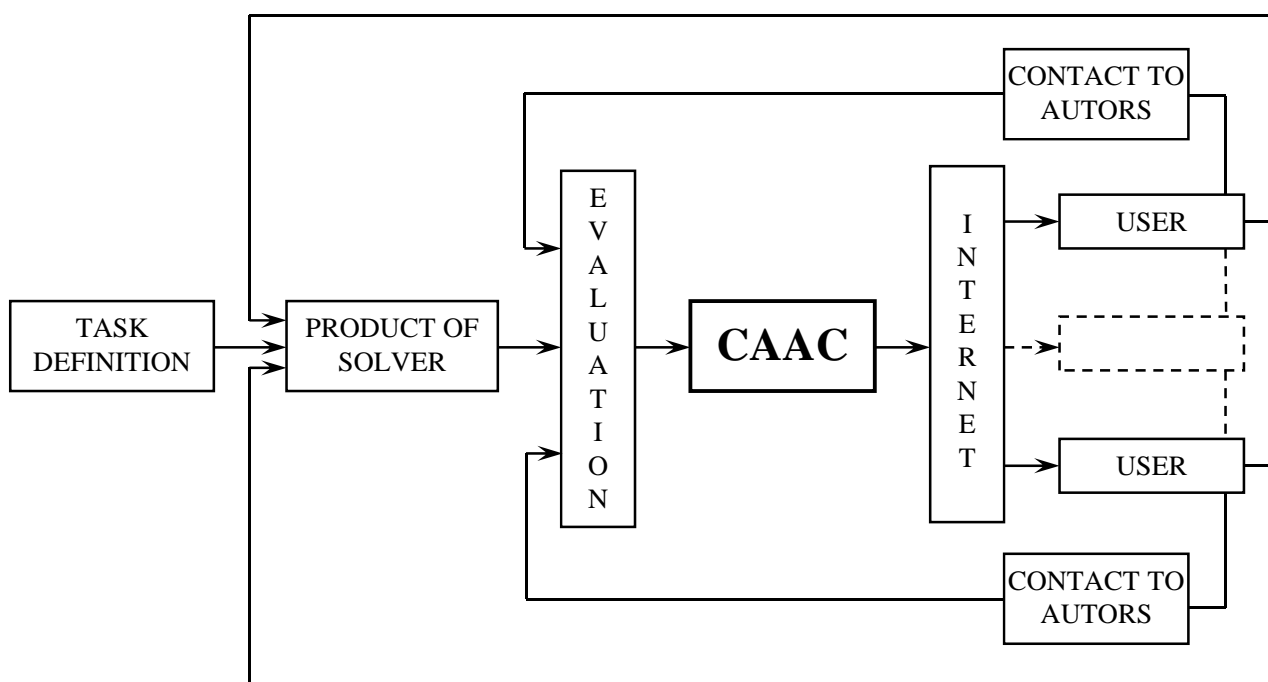

Fig. 5. Information flows in the CAAC information system

At present it is created a lot of electronic utilities and information systems that deal with an area of the automatic control. These ones have been created especially at universities, i.e. TU in Ostrava, TU in Liberec, etc. (Wagnerova & Minar, 2000; Wagnerova & Minar, 2000; Viteckova, 1999; Linka, 2007).

5. Present situation

At present, the CAAC information system has on webpages partially loaded the subsystems "Analysis", "Synthesis", "Logic control", "Identification" and „Library of complete programs", i.e. in the subsystem "Analysis" there are 10 basic sub-modules, in the subsystem "Synthesis" 20 basic sub-modules, in the subsystem "Identification" there are 4 basic sub-modules, and in the subsystem "Logic control" 11 basic sub-modules. The subsystem "Library of complete programs" comprises 6 finished programs. At present time, chosen webpages are accessible on the Internet (*http://www.caac.zde.cz*). For the time being, these webpages have been created in the Czech language.

6. Conclusion

The aim of this paper was to demonstrate one of the possible approaches to education realization for the area of automatic control by utilization of webpages on the Internet. Described the CAAC information system is proposed as a tool for realization of an electronic support of education in the area automatic control. This information system represents a certain form of e-learning, which has been discussed a great deal and promoted recently.

7. Acknowledgement

8. References

Balate, J.; Klostermann, T.; Hlavizna, K. & Sysala, T. (1996). Computer Aided Automatic Control, *Proceedings of New Trends in Automation and Measurement*, STU Bratislava-Kocovce, Slovak Republic, pp. 29-36. (in Czech)

Linka, A. (2007). TUL E-learning system, *Available from*: http://e-learning.tul.cz *Accessed*: 2007-05-02 (in Czech)

Navratil P. (2004). *CAAC information system - Computer aided automatic control* (Dissertation), TBU in Zlin, Czech Republic. (in Czech)

Vesely, L. (2006). *Usage of the modern tools to modification of CAAC information system on webpages* (Bachelor's work), TBU in Zlin. (in Czech)

Vesely, L. (2008). *Calculation module for the CAAC information system* (Diploma work), TBU in Zlin. (in Czech)

Viteckova, M. (1999). The mathematic methods used in the area automatization and control, *Available from*: http://www.fs.vsb.cz/books/matmet/ATR.htm *Accessed*: 1999-06-18 (in Czech)

Wagnerova, R. & Minar, K. (2000). Tutorial for the analysis of control loop, *Available from*: http://www.fs.vsb.cz/books/Analyza/index.html *Accessed*: 2000-07-21 (in Czech)

Wagnerova, R. & Minar, M. (2000). Control loop synthesis, *Available from*: http://www.fs.vsb.cz/fakulta/kat/352/uc_texty/Synteza/index.htm *Accessed*: 2000-08-22 (in Czech)