

E-content Development and Task Solution Using the Content Management System of Online-CADCOM

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Abstract – The paper presents different types of e-content in Online-CADCOM and the methodology steps for its development, using Content Management System. The methodology is illustrated by adding e-content for a new online tool WEBENCH Clock Architect (TI). Later a design and verification task is solved using the new tool from the CMS and the simulator ORCAD Design Suit for verification.

Keywords – E-content, Content Management System, E-content development, Design and verification task solution, PLL loop filter design.

I. INTRODUCTION

Online-CADCOM [1,2] content is dynamically generated from the Content Management System (CMS) [4], once the content is successfully developed and uploaded through the user interface. The platform has unique and major capabilities which turn Online-CADCOM in powerful web platform that has the following features through the CMS platform:

- Automated templates – new content is automatically applied to the existing templates and views, as also all content can be changed from a central place.
- Access control – user groups allow Online-CADCOM to be controlled on different hierarchical levels and they determine how registered users interact with the CMS system
- Scalable expansion of content – the CMS platform offers ability to expand content in future work as adding more files, new categories and etc.
- Easily editable content – the content is separated from the visual presentation of the web platform and it is very easy to edit and manipulate by non-technical users, which is the main focus and idea of using CMS approach.
- Workflow – technique used for uploading a content in the platform which gives abilities for workflow management and multiuser parallel tasks.
- Collaboration – the content of the platform is retrieved and uploaded by one or many authorized users. Changes can be made from all authorized users, and this can be considered as advanced form of collaboration that allows multiple users to make changes of a content material at the

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same time, from different geographical locations.

- Delegation – user levels of access provide limited access for different user groups over specific sections of platform, which divide into small part the responsibility for the management.
- Content Virtualization – CMS platform allows each user to work with a virtual copy of the whole web site, documents and resources included. This feature enables changes to multiple resources to be viewed prior to submission.
- Multilingual – with the developing of the CMS, the multilingual functionality is embedded. This gives the ability to display the content in different languages, not only the native.

The paper is organized as follows: Types of e-content and methodology steps for e-content development, using the CMS menus are described firstly. The process is illustrated for the integration of a new tool WEBENCH Clock Architect (WBCA) [7]. Then task solution using the platform is illustrated through an example of design and verification of PLL (Phase-locked loop) loop filter using WBCA tool and ORCAD/PSpice simulator.

II. E-CONTENT AND METHODOLOGY STEPS FOR ITS DEVELOPMENT IN ONLINE-CADCOM

A. E-content in Online-CADCOM

E-content development using CMS platform is an intuitive process, thanks to the proper scalability of the platform as described in [3]. The content of Online-CADCOM would not be limited only to online tools. The platform is built by different types of e-content with different specifications and functions. In CMS, the approach used to develop and create e-content is using methods for CRUD (Create, Read, Update, Delete). These main methods are implemented in buttons that are visible in the bottom of each section of platform – “Add”, “Show”, “Edit” and “Delete”. Moreover, the content is highly protected using a login screen for the platform and also different user-type levels as described in [3] with different levels of access and platform rights. Development of e-content can be conditionally divided into:

- Categories,
- Tools,
- Portals,
- Standards,
- Knowledge Base,
- Estimation tools,
- Prototype tools,
- Optimization tools.

Categories in the platform are related with Panel 1 and 2, which cover the Daniel-Gajsky Y model used in Online-CADCOM and represent the content related with the categories of this model. These categories can contain both subcategories and online tools with individual tool passports. Adding a category does not affect tools and vice versa. This means that the two sections are separate and independent and the content is not connected, but separated in the categories.

In CMS, the tools section gives the opportunity to develop content related with different online tools. A tool passport is used as described in [3] for identification of the tool before integration in the platform. Here, different tools are added, edited and deleted. During the process of development the content provides an option to choose the related category or subcategory for the tool which is added.

The section with portals gives the possibility of adding different type of engineering portals that can contain useful and important information about all users that will use Online-CADCOM. The information is not limited to text, but also to images and video files, which make this section an extremely useful for quick and reliable information and future links to useful products that are out of Online-CADCOM scope.

"Standards" is another section in the platform that provide the users with information about different standards in telecommunications and system design. Information here is not limited to name, date and title of the standard but a standard can also be downloaded from the platform using the button "Download". The platform is developed in a way that content can be up to one document per title and the document formats are limited to *.doc, *.docx and *.pdf. Limitation is needed for storage optimization and also virus, worms and adware protection of the E-content.

The Knowledge Base contains a large number of materials in different categories. Visitors of Online-CADCOM can view and download knowledge materials such as how-to documents, videos and another knowledge material.

"Estimation tool" section of CMS allows the administrators to upload estimation tools in the platform as the logic is the same as the tools in the Y model of Panel 1 and Panel 2, but without subcategories. This limitation is done because of the used method of showing items from this menu – using dynamic number of pages according to the number of Estimation tools. Here the same approach for tools classification, using tool passports is covered.

The section "Outcome to prototype" is developed for e-content related with tools that can be used for prototype engineering work.

Optimization menu is developed for tools that are used for optimization task and solutions.

The CMS is developed to facilitate the work of Online-CADCOM administrators and to make content development and upload easy and fast task, without need of programming skills. The scope of using the platform is tasks solving related with the e-content in Online-CADCOM. Some of the options of CMS are:

- New Category/Subcategory creation through CMS;
- Adding a new tool with passport in a specific Category;
- Developing/Adding e-content in the Knowledge Base.

B. Methodology steps for e-content development in Online-CADCOM

The main methodology steps for e-content development in Online-CADCOM, using the CMS are: Adding a new category/subcategory; Adding a new tool in a category; Passport filling for a new tool; Development and adding e-content in the Knowledge Base to help task solution with a set of tools.

These steps are considered in details and they are illustrated through the example of adding the new Online tool WBCA, which is a module in the Online Platform WEBENCH Design Center of TI [8], in a new subcategory "PLLs". The new tool permits design, simulation and optimization of clock tree solutions for given input and output frequencies. The main circuit used is the PLL. Details about PLL design and important building blocks as Voltage-controlled oscillator (VCO) and PLL loop filter can be found in [6]. More about datasheet specification reading of a PLL device is presented in [5].

Adding new subcategory

As described in [3], categories in Online-CADCOM are related with Panel 1 and Panel 2 of the front page. More categories or subcategories can be added through the Content Management System and they automatically stand behind the main categories that build up the Panel 1 and Panel 2. This approach is used because of Daniel-Gajsky Y model and tools classification according to it. Category creation is easy and can be made from the platform menu – "Categories". After opening this menu, the main screen shows all the current categories that are created in the system. These categories correspond to the names of the buttons of Panel 1 and Panel 2. As described above, a category can contain a subcategory. For creation of a new category, the button "Add" must be pressed. Categories can be deleted using button "Delete".

For the needs of the new online tool, a new subcategory "PLLs" has to be created in the existing Category "RF and Microwave".

Adding a new online tool

Tools can be added to the platform using the section – Tools. First when this button is clicked, a window with all tools is shown on the screen. A new tool can be added using the "Add" button. The process is the same as for adding a new category/subcategory, but here the user must fulfill the form that represents the tool passport with all information related to the specific tool. The development of the e-content for the online tool content must be consistent with the categories. If there is no category, no tools can be added. Also when a tool is added, a selection form with the category must be chosen, otherwise the platform generates an error. Tools can be easily removed using the "Delete" button.

Figure 1 illustrates the creation of the e-content for the new online tool WBCA. The creation of the content for the new tool begins with the name of the tool and an image symbolizing the tool. The image chosen to symbolize the WBCA is a clock tree block diagram. The web address of the new online tools is added in order to perform "Launch"

function for accessing and running the new tool. Figure 2 illustrates the vision of the new tool on Panel 1, subcategory “PLLs” of the Category “RF and Microwave”.

Passport filling for a new tool

Figure 3 illustrates the parameter filling in the passport of the tool WBCA and Figure 4 shows the e-content of the passport filled, visualized by Online-CADCOM. The new tool is a module in the online platform WEBENCH Design Center of TI. It's acting at the transistor level from the Daniel Gajsky Y-model. The application area is defined as PLL design and simulation, the functions are selected from a predefined set, then input/output connections with other existing tools are enumerated and ORCAD/PSpice is pointed as a verification tool. Some quantitative and qualitative features are added in the last 2 fields of the passport. The input/output connections show possibilities for combining the tool WBCA with other tools for solving complex design tasks.

Developing and adding e-content in the Knowledge Base

The Knowledge Base contains different type of materials and files, which help engineers to solve complicated tasks. Knowledge Base materials can be of any kind of files – documents, pictures and etc. Uploading a Knowledge Base material is an automated task that requires only to fulfil the forms of Knowledge Base section and to point a file to be uploaded. A new knowledge material can be created with the button “Add”. Then a window with forms for creation of the material is shown. After completion of filling forms, with the button “Save”, the new knowledge material is added to the database and is ready to be visualized in Online-CADCOM. Instructions for how to combine tools in Online-CADCOM, in order to solve complex design and verification tasks, are part of the e-content in the Knowledge base. A new instruction for verification of the PLL loop filter designed with WBCA, using the simulator ORCAD/PSPICE is uploaded to the Knowledge Base.

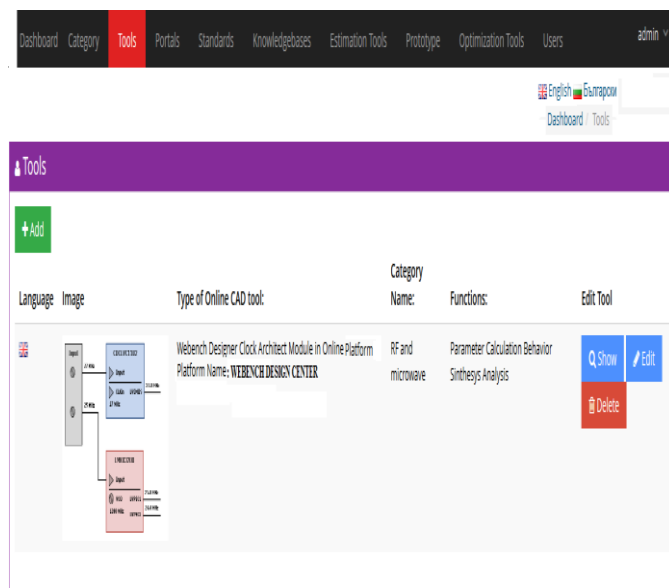


Fig.1. Adding New tool WEBENCH Clock Architect in the category “RF and Microwave”, subcategory “PLLs”

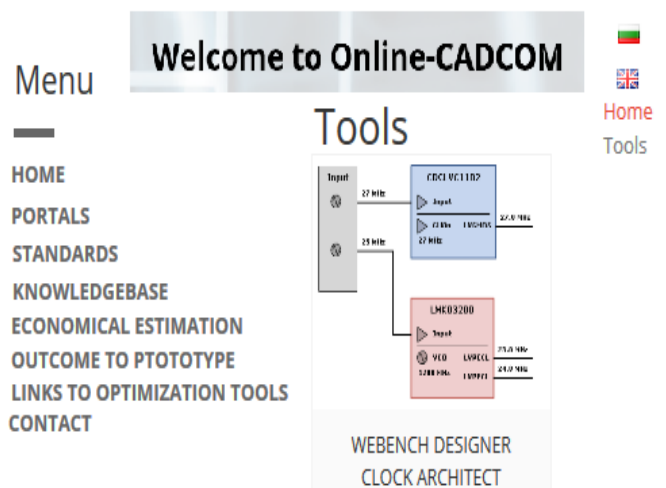


Fig.2. Visualization of the tool WEBENCH Clock Architect and its image on Panel 1

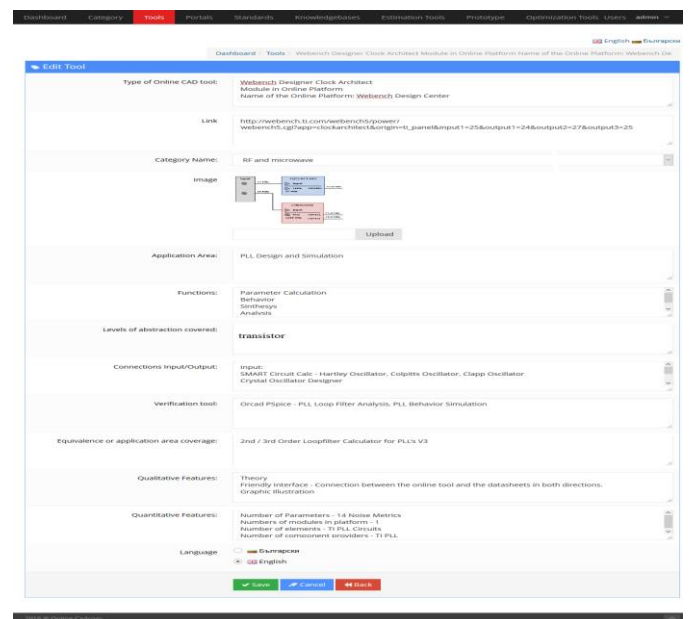


Fig.3. Filling e-content for the passport of WEBENCH Clock Architect

Tool passport	
Type of Online CAD tool	Webench Designer Clock Architect Module in Online Platform Name of the Online Platform: Webench De
Category name	RF and microwave
Application Area	PLL Design and Simulation
Functions	Parameter Calculation Behavior Synthesis Analysis
Levels of abstraction covered	Transistor
Connections Input/Output	Input: SMART Circuit Calc - Hartley Oscillator, Colpitts Oscillator, Clapp Oscillator Crystal Oscillator Designer Output: EEZ Match - Matching VCO with load; VIVADO, ISE (yilinx), QUARTUS II (Altera) - Divider Circuit Design with VHDL;
Verification tool	Orcad PSpice - PLL Loop Filter Analysis, PLL Behavior Simulation
Equivalence or application area coverage	2nd / 3rd Order Loopfilter Calculator for PLL's V3
Qualitative Features	Theory Friendly Interface - Connection between the online tool and the datasheets in both directions. Graphic Illustration
Quantitative Features	Number of Parameters - 14 Noise Metrics Numbers of modules in platform - 1 Number of elements - TI PLL Circuits Number of component providers - TI PLL

Fig.4. Visualization of the passport filled in Online-CADCOM

III. DESIGN TASK SOLUTION IN ONLINE-CADCOM

Once the WBCA tool is integrated in Online-CADCOM, it is used for design verification combining the online tool with Orcad Design Suit 16.6 program [9] and PSpice simulator, following the instructions given in the Knowledge Base.

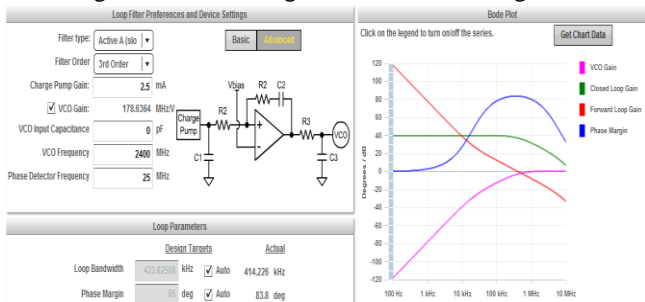


Fig.5. Loop filter design circuit, parameters and simulation results in WEBENCH Clock Architect

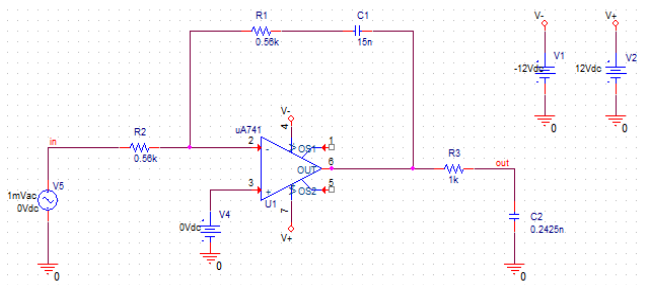


Fig.6. Circuit of the loop filter in ORCAD/Capture 16.6

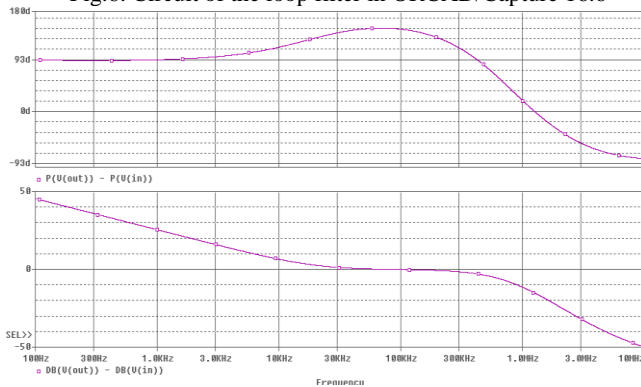


Fig.7. Gain and Phase simulation curves of the loop filter from Fig.6 simulated in ORCAD/PSpice 16.6

First a clock tree with specification for an input frequency of 25 MHz and 3 output frequencies of 24 MHz, 27 MHz, 24 MHz is designed. One of the 10 proposed solutions is considered. Then the **LoopFilter>Advanced** options are selected. The circuit selected is Active A (low slew rate) 3rd Order. The filter circuit and the curves simulated in WBCA are presented on Figure 5. The parameters of the loop filter obtained by WBCA are: Bandwidth – 414 kHz and Phase Margin - 83.8°.

Then the circuit of the loop filter is drawn in ORCAD Capture as shown on Figure 6. The circuit is with negative feedback which follows the theory in [6] and gives meaningful simulation results. The filter from Figure 6 is simulated in frequency area (AC) and the curves for the Gain and the Phase are presented on Figure 7. The loop filter parameters

determined from the simulated curves are Bandwidth – 428 kHz and Phase Margin - 92.5°. The curves from Fig.7 are similar in form as the curves of Forward loop gain and Phase Margin from Fig.5, but there are some differences in the values of the parameters obtained. It would be good to know the motivation for using the positive feedback circuit in WBCA on the other hand, it's worth to verify the designs with ORCAD/PSpice and to search the most realistic solution, as basis for further optimization of the clock tree design.

IV. CONCLUSION

Using the CMS for e-content development and for task solution is a job that does not require special programming skills. E-content can be easily created with help of few sections and buttons. The platform is intuitive and easy to operate with. Content can be changed dynamically and anytime. The ease-of use is illustrated by adding e-content for the online tool WBCA to Online CADCOM. A process of adding e-content for hundreds of online tools is foreseen in near future. The results from the design and verification task show that such a study is needed in order to compare results and to fix better parameters obtained and to optimize designs.

ACKNOWLEDGEMENT

This research is partly supported by Project №152PD0039-07 in Technical University – Sofia.

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