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CAD for CATV Design

B.N.Shelkovnikov¹, Djuradj Budimir²

Abstract - Software packages in design of cable TV networks created by different firms and companies were observed and analyzed by functional abilities and application areas. Examples of CATV network design are given.

Keywords – CAD, CATV, network, design, software.

I. INTRODUCTION

Most of CATV networks can transmit only television signals and follow the tree architecture with downstream (Fig.1) information transmission from the "head end" to branches and leaves (users) using amplifiers and splitters. Head end - is a satellite station or multi-channel transmitter of TV signals. Branches of the tree - are usually coaxial or fiber-optic cables [1,2].

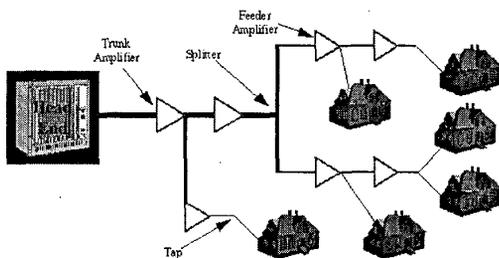


Fig.1. Downstream CATV network

Under the total growth of quantity and quality of services (control, management, additional information service - telephony, Internet and oth.) the necessity to transmit information from the subscriber to the "head end" has appeared - an upstream (Fig.2).

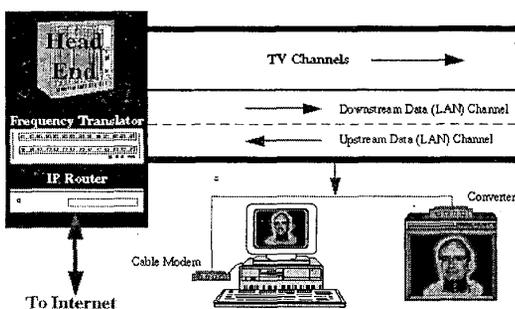


Fig.2. Downstream and upstream CATV network

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This transforms CATV network to broadband distribution network for integrated analogue and digital information transmission. To realize such a network a technology of broadband computer networks is applied.

To design the devices, nodes and networks of CATV not only separate programs for computer-aided design are used; but also complicated integrated systems for CATV networks design (CATV CAD) and for integrated networks (Opnet, ...).

II. SOFTWARE FOR CABLE TV NODES AND NETWORKS DESIGN

Existing software for CATV design, first of all, differs by its characteristics, which defines its structure and functions. The most simple and limited in functions is the program called TV Designer [3]. It is intended for the calculation of television distribution networks and allows creating these network schemes using multitude of elements, to calculate characteristics and to show the report with obtained results. Analysis and calculation of upstream is not provided (Figs 3 and 4).

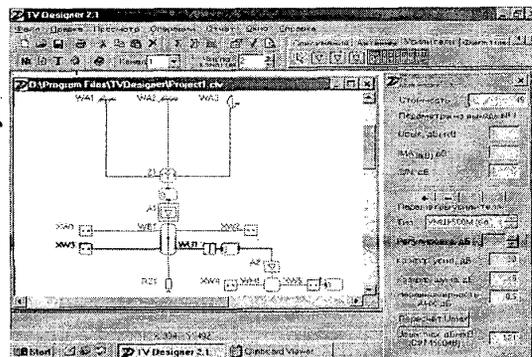


Fig.3. Television distribution network (TDN)

Элемент	Тип	Соглаш. / Шкала	Вход	Выход
Амплификатор	Амплификатор	1	100	110
Амплификатор	Амплификатор	2	100	19
Композитный делитель	ВЧ ДС	1	100	100
Делитель частоты	СМД-102 ВЧ ДС	1	5,85	1,35
Делитель частоты	СМД-102 ВЧ ДС	1	10	10
Делитель частоты	СМД-102 ВЧ ДС	1	3	3
Отделитель нос. к.	РА-50410 ВЧ ДС	1	4,9	4,8
Реле для коммутации	ДЧ ДС (VSB)	4	5,3	21,7
Реле для коммутации	Реле для коммутации	1	5	5
Усилитель	УМЧ-100 ВЧ ДС	1	45	45
Усилитель	УМЧ-100 ВЧ ДС	1	45	45
Сплиттер	С	1	0	0
Экранирование	СДЧ ДС	1	10	19
Исходная мощность				110,00

Fig.4. TDN calculation results

The program called **Cable Television Design Program** (CATV CAD) [4] created by "GEN Enterprise Ltd." is processed with a purpose of cable television networks design, but also can be used for local cable systems design. Block-scheme mode allows conducting a full calculation of network characteristics, including C/N, CTB, SCO, signal levels and oth. The cost of block-scheme components can also be calculated and output in a file or electronic table. Map mode allows to snap a network to the real scheme of backbone cable laying and oth. The CATV CAD is a Windows (3.1, NT, '95) based program designed to aid the CATV designer to quickly and accurately design cable television systems. The program does a Forward design using three user specified frequencies and a Reverse design using two user specified frequencies. The program can also be used to do optical fiber designs. The name of the design program is DESIGN.EXE. The ACAD option allows the designer to load common CATV device symbols into an AutoCad (Ver. 12 to Ver.14) drawing, identify cable types and distances between devices, identify end tap output levels and set particular tap spigot levels for apartment feeds. An aid for doing powering calculations is included. This program is called PWRDES.EXE. An Excel program has also been included to help the designer process the final powering design. The DESIGN.EXE program uses equipment data files (which are produced and edited by the user) to input the various equipment specifications into the design program. The name of the program, which produces and edits these data files, is CABEDIT.EXE. CABEDIT.EXE reads and writes to several data files containing the equipment specifications, which are subsequently read by the main design program DESIGN.EXE in implementing the design.

The **Symplex Suite** of programs (SpanPro, Inc.) [6] is a collection of applications designed for broadband cable system owners, operators, engineering subcontractors, and support personnel. This suite of programs both manages and models modern coaxial broadband networks. These networks consist of amplifiers, splitters, cable and taps located on poles, underground trenches, and buildings. Symplex R2 is the core module, which allows design engineers to construct, test, and optimize a virtual cable network at ten different frequencies. The second module, Symplex manager, is geared for design support and administrative personnel. It allows them to produce cost reports, bills of materials, and track the status of designs through a simple interface that does not require knowledge of system design or the design module. The third module is Spec Manager. This module is used to create, manage and modify the equipment specification files that Symplex uses for its modelling formulas. Specification files usually have to be created for each project and this module allows groups of equipment and project settings to be moved from one file to another with ease.

Program system **Lode Data Corporation** [7] includes four modules: Design Assistant, Drafting Assistant, Performance Calculation and Design Assistant Viewer. The Design Assistant is a Computer Aided Engineering System for the design and optimization of broadband coaxial networks, ranging from citywide cable TV networks to computer Local Area Networks (LAN). The Drafting Assistant customizes AutoCAD to be a powerful CATV and Utilities mapping

program. The Performance Calculator is a quick and easy to use program for calculating distortions (C/N, CTB, CSO, and Xmod) in the system. The Design Assistant Viewer is a read-only program that will look at an existing Design Assistant network.

The Drafting Assistant customizes AutoCAD to be a powerful CATV and Utilities mapping program. We have harnessed the power of AutoCAD with specific, yet flexible routines to draft base, strand, geography, and as-built. Design Assistant networks can be imported directly into the Drafting Assistant. All cable types, tap values, amplifiers, data blocks, etc. are imported from the Design Assistant, greatly increasing drafting efficiency and eliminating errors. Everything within the Drafting Assistant is completely user customizable. That is, you can use all your own blocks, line types, layers, scale factors, grid layouts, etc. All customizations for each project are saved in settings files, so switching between projects is as easy as loading a different project file. Below is a quick breakout of a few of the features that will save you time and money.

The Performance Calculator is a quick and easy to use program for calculating distortions (C/N, CTB, CSO, and Xmod) in the system. The Performance Calculator allows the user to create a database containing performance data about their amplifiers.

The Design Assistant Viewer is a read-only program that will look at an existing Design Assistant network. The Viewer has an easy to learn, highly customizable interface that allows you to view only the information you want to see.

Software of **CADIX International Inc.** [8] includes:

- CX-P21-RF - CATV design system;
- CX-P21-FD - fiber-optics design system;
- CX-P21 - cable management system;
- CX-T21 - tutorials - full - functional design programs
- CX-T21-RF - for CATV design
- CX-T21-FD - for fiber-optics design and management.

The Cadix CX-P21-RF CATV design system automates the plant design process, performs engineering analysis, and assists in plant maintenance. CX-P21-RF is easy to learn and easy to use. It was created specifically for the use of the cable industry to design RF networks, so there is none of the overhead associated with traditionally CAD programs modified for CATV usage. This results in significant increases in design productivity, making CX-P21-RF an outstanding value for any CATV company.

The Cadix CX-P21-FD Fiber Design System automates the layout and management of the fiber plant. The system automates the design, creates the splice connections, and calculates distances and fiber count. Designers place optical elements with a simple click of a mouse button. Graphically-created splices produce the textual splice charts, and reports are produced with fiber count and distance information automatically entered for use by engineering and management.

CX-T21 Cable Design Training Applications make training personnel affordable, even for the smallest cable operation. The user-friendly graphical user interface provides a smooth transition from field experience to design work. And because

they're True Cable applications, CX-T21-RF and CX-T21-FD are intuitive and easy to learn.

The Cadix CX-P21-CM Cable Management System merges fiber design, RF design and analytical data with legacy data to provide a unified enterprise-wide relational database. CX-P21-CM shares design elements such as maps, drawings and bills of material (BOMs) throughout the enterprise. In addition to providing a "one-stop" design tool for engineers, all information is available to be included in reports used for construction, finance, marketing and trouble-shooting. Even detailed "what-if" scenarios can be created as a management tool.

CableTools [9] is a computer-aided design & drafting (CADD) system. The Design Tools are standalone Windows programs while the CAD portion uses AutoCAD, AutoCAD LT, or IntelliCAD as its foundation.

CableTools Design was created from the start to take advantage of the best features of the Windows operating system: pull-down menus, right-click menus, double-click, drag-drops, cut & paste, tool-tips, context-sensitive help (Figs 5 and 6).

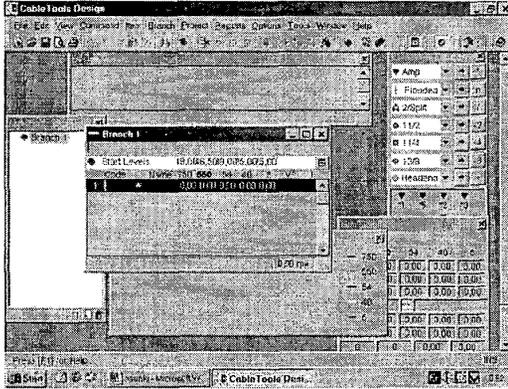


Fig.5. Windows CableTools Design

Design works in tandem with CableTools CAD to make going from design to finished map a single, synchronous task. The CAD Interface allows the user to interactively create a drawing even while designing it. Design simultaneously calculates up to five frequencies you specify (a limitation to be removed soon) and can be set to design using any or all of those frequencies. If any frequencies are not used, they can be turned off to reduce clutter in the display. All frequencies can be set for either forward or reverse calculation.

CableTools CAD works alongside a standard CAD program like AutoCAD, AutoCAD LT, or IntelliCAD to produce high quality map drawings. CableTools CAD comes equipped with over 100 cable telecommunications symbols for base, strand, passives, and electronics drafting, including all the standard NCTA/SCTE symbols. A single pull-down menu is placed in the CAD program to access all the CableTools commands with the keyboard or mouse. In addition, a customizable toolbar can contain any or all of the available symbols for speedy command selection. Drafting is as easy as selecting a command then clicking in the appropriate spot on the map. CableTools automatically manages the sophisticated structure

of over 50 layers, invisibly categorizing the map data. CAD may be used in combination with CableTools Design. Through the Design CAD Interface, predesigned projects can be quickly transferred to CAD maps without the need for an intermediate paper printout. The CAD Interface automatically drafts person merely points to where the devices will go and continues on.

CableTools Design makes the proper device selections in the CAD program. It is offered in four levels: Tech, Designer, Pro, and Developer. All levels of the CableTools system are built on a single platform and share the same components.

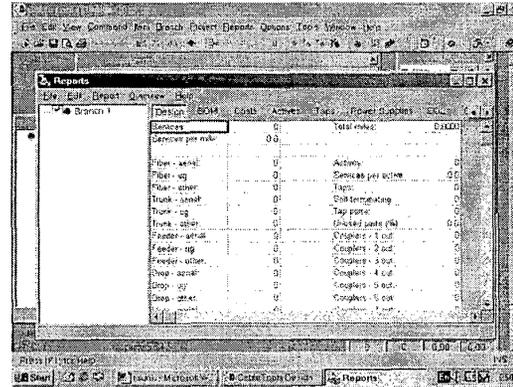


Fig.6. Calculation results

Since the July 2000 Goldcom Inc. issues a new program package **Fusion**. It integrates functions of the four previous levels and is realised on a new structure with new properties. Fusion is more than simply CableTools 3.0. Its major innovation is the Fusion of design, drafting, and other functions into a single, standalone application.

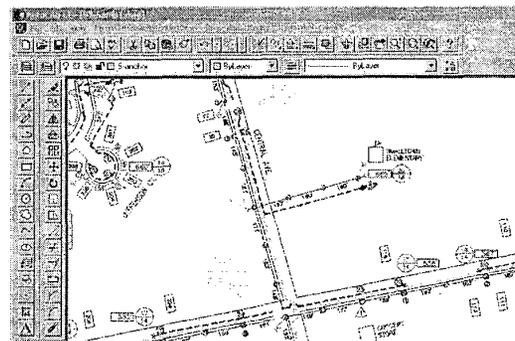


Fig.7. CATV topology

Fusion incorporates DWG format technology to integrate drawing manipulation into its core application. The result is a highly efficient and productive CADD platform that doesn't rely on continually changing third party CAD programs, yet produces standard AutoCAD DWG format drawings.

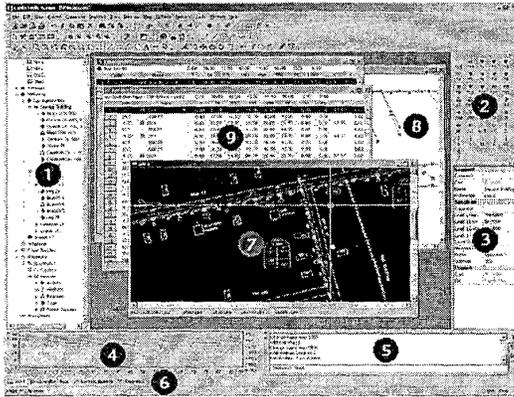


Fig.8. Windows Fusion

Other enhancements in Fusion are more evolutionary than revolutionary. While borrowing heavily from traditional cable industry CAD products, Fusion also takes some of its ideas from the more capable six-figure telecom systems.

III. CONCLUSION

The common part for the whole CAD CATV is the existence of both text and graphic interfaces, element and graphics editors, database and libraries, information output service.

Among the observed software packages the most powerful by its functional abilities is the software by Cadix International Inc. [8] and Goldcom Inc. [9]. Thus CableTools

and Fusion are capable of designing various broadband networks containing fiber-optic cables, coaxial networks, twisted-pair based networks, radio networks and future technologies.

The authors think that results of this work would help designers and operators of CATV networks to direct their thoughts on a huge amount of software for the design and control and to choose the most effective and optimal in using. Readers will get an opportunity to get acquainted with an information in the field of CATV networks computer-aided design.

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