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FIVE DIFFICULTIES OF ELECTRICAL ENGINEERING

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Abstract- Electrical engineering takes important place in technical progress and development. Achievements of electrical engineers and scientists make easy our today life and work. Every minute of our life, each of us face with results of intelligent brainwork of numerous army of electrical engineers. Electrical devices stable come into our everyday life. It is impossible to imagine our further existence without these devices. However, not everything is so easy and simple in electrical engineering similar to the other engineering disciplines. Electrical engineers continuously faced with the problems and difficulties during solving of project's tasks. This article presents determination of five common difficulties of electrical engineering.

Keywords: Electrical Engineering, Design Problems, Engineering Management, Project Management, Time, Cost, Resources.

I. INTRODUCTION

It is impossible to imagine modern world without electricity. Electrical systems fully integrated into the human everyday activity from early morning for example as an alarm clock till to the night as night lighting. Electrical devices smoothly support and make easy our life. We can see that electricity help us to move, to work, to study, to enjoy, saving of health and environment. By another words electricity is one of the major support part of a modern life. Behind of all these achievements stays a big and strong army of electrical engineers and scientists.

Electrical engineering as a science is not as ancient as a, for example, philosophy or medicine but it plays very important role in development of the humans future. Fast growing of technology raises new tasks and problems to the electrical engineers, rapidly and continuously increases the level of requirements to the electrical design approaches and methods. So nowadays design teams should be competent, flexible and resourceful for solving of all aroused problem and tasks in time. Of course all of mentioned above create numerous difficulties for organic improvement of electrical engineering and science. This article will present determination and review of five common difficulties of electrical engineering that can help to facilitate management of design process.

II. DIFFICULTY NUMBER 1: WIDE RANGE OF DESIGN AREAS

Electrical Engineering is a complex and widespread technical science. In view of wide diffusion of electricity inside of all human activities, occurred big quantity of various technical systems based on electricity. These systems required for solution different technical tasks, for example such as lighting of territory and objects, protection of people from injures by current, protection from lightning strikes, providing of interruptible functioning of electrical devices and machines, etc. Most widely distributed groups of electrical systems listed below:

- Electrical power production systems,
- Electrical power distribution systems,
- Electrical illumination systems,
- Earthing protection systems,
- Lightning protection systems,
- Heat tracing systems,
- Cathodic protection systems,
- Control and Instrumentation systems,
- Electronics systems,
- Telecommunications systems,

Of course, presented list is not full and each item of it can be enlarged, but this list visually demonstrate how broad field of activity and level of responsibility of modern electrical engineer. Also, by taken into account the speed of science and technology development, appearance of new types of materials, increasing levels of requirements for quality of products, raising of protection levels of peoples and environment, we can imagine the volume of information and data which should be processed by today's design engineer. This hard work up should be performed for increasing of electrical engineers ability for creation technical solutions that should be modern, flexible, easy executable, safe and not expensive.

On the base of presented above information can be formulate following determination of Difficulty Number 1 is wide range of design areas required a lot of time and efforts for study and process big volume of various information and knowledge which necessary for design of mentioned electrical systems in accordance with modern requirements.

III. DIFFICULTY NUMBER 2: VARIETY OF POWER SYSTEMS IN THE WORLD

Fast and parallel development of electrical science around the world brings to origin big quantity difference power supply systems of various countries. Such variety is negative influence over development and activity of electrical engineers around the world. Engineers, who work on international projects, during development of technical solutions for any country, need take into account all specific details of power supply network concern to this country. Study of standards requirements and practices for design solutions required spending of additional time and efforts from electrical engineering team and usually this negative reflects on the overall project schedule.

Presence of different systems and methods not allow designing engineers' creation of universal technical solutions. Application of new technical solutions created for one of the systems required additional operations on adaptation for possibility of using these solutions for another system. One of the powerful tools of nowadays engineers is personal computer. Today at the engineering market presented big amount of various software for electrical engineers, but absence of universal approaches and methods does not allows development of united software complex which in the century of computer technologies will be modern and powerful tool for all electrical engineers around the world. Therefore, Difficulty Number 2 is variety of power systems in the world doesn't allow engineers creation and using in projects universal technical solutions.

IV. DIFFICULTY NUMBER 3: PLACE OF ELECTRICAL ENGINEERING TEAM IN PROJECT FRAME

Modern project is complicated many-sided mechanism with accurate targets, defined barriers, and resources, limited by time and budget. However, the heart of this complex mechanism's is the project's team. Teams of modern projects consist of various discipline engineers: civil, process, mechanicals, electrical, etc. Each member of project team performs his personal tasks. In addition, for successful and timely finishing of project is required that each member of project team should perform his personal tasks right and in time. Usually electrical engineers start project only after the engineers of another discipline determine base conceptual solutions of their tasks. So it possible to say that beginning of activity of electrical engineering tem don't coincide with the project start and shifted for time required for determination of conceptual design solutions by another groups of engineers.

Usually this stage of project is dragged out by approvals of conceptual solutions and electrical engineers start the project with the delay in project schedule. Also incomplete and ill-timed transmission of information from another disciplines leads to appearance of deviations and mistakes. Corrections of these deviations and mistakes required additional time and human resources in condensed project schedule.

Thus, time of starting for activity and condensed time of performing projects tasks by electrical engineers' team raises the next Difficulty Number 3 is place of electrical engineering team in project frame.

V. DIFFICULTY NUMBER 4: USERS TECHNICAL BACKGROUND

Fast growing of quantity of electrical systems required more technicians. Satisfying of this request it is necessary to speed up the education, but this acceleration not allows giving to the students more deep knowledge. In addition, as the results very often operators who work with the modern system do not have strong and deep knowledge. At another side modern life's requirements to the products quality, environment and human protections are increasing every year.

Improvement of technical systems performs for satisfaction of these requirements. Engineers should design smart and intelligent systems that will function automatically with minimal human participation. More and more system's operators perform only visual control. But development and implementation of such systems required additional knowledge, tools, time, tests, calibrations and verifications from engineers. Engineers should not only find technical solutions for task and need to create model of system. After that should be performed analysis of model's behavior for various scenarios. All of these increases the cost of designed systems and make the engineers activity more complicated.

Difficulty Number 4 is users technical background as usual not at the required level and design engineers need to spend additional resources for development smart and intelligent systems which operates automatically and minimize the human factor.

VI. DIFFICULTY NUMBER 5: COST BALANCING OF DESIGNED SYSTEMS

One of the important parts of each project is a cost of designed systems. Very often electrical engineers should to solve difficult contradictory tasks, solution of which required finding masterly solutions for keeping balance between the required and enough. Designed systems should not be expensive, but should be:

- Modern
- Based on using new materials and technologies
- Safe for people and environment
- Reliable and redundant
- Durable with long design life
- Easy and quick constructible
- Simple maintenance
- Lowest operation and maintenance costs

Of course, balancing of the cost for designed systems required from engineer strong and flexible knowledge base, competence the latest achievements in materials and technology markets, feeling of the project important requirements, etc. Therefore, the last problem determined in current paper is Difficulty Number 5 is cost balancing of designed systems.

VII. CONCLUSIONS

Determinations of difficulties presented in article indicate the complexity and nonlinearity of engineers' job. Further analysis of difficulties that faced in electrical engineering everyday activity allows improving design approaches and methods for achievement of high design levels that influences to the humans life.

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