Chapter 1: Multimedia textbook

Introduction

The life of today's society requires transmitting and receiving more and more data. Since the capacity of today's communication channels is not sufficient, new channels in higher and higher frequency bands have to be built.

Design of electronic circuits, antennas and other systems, which are required to operate at frequencies of tens to hundreds gigahertz, is rather difficult. This is given by the fact that phenomena at the above-specified frequencies are of wave nature, and therefore, all the analysis and design have to be based on Maxwell equations in differential or integral form. Understanding phenomena, which are described by differential or integral equations, makes usually troubles to students.

A relative complexity and abstractness of the mathematical description is the first cause of troubles (how can students imagine curl or divergence operators, special integrals, etc.). Handling complex vector operations, one can hardly imagine their concrete sense and practical signification.

A relatively complicated and abstract nature of wave phenomena is the second cause of troubles (how can students imagine EM wave propagation along the microstrip transmission line). Properties of studied phenomena and systems and their mutual relations cannot be observed in a direct way, but only by the indirect one.

The electronic textbook we have in our hands now, tries to solve the above-described problems. The textbook is going to explain, using simple examples, the practical signification of complicated mathematical operators. The textbook is going to visualize the studied phenomena in order to build a right notion about their matter and their mutual relations. The textbook is going the ways of exploiting examined phenomena in the engineering practice.

The textbook is conceived as a set of selected topics, which are harder understandable.

The electronic textbook is not a classical textbook describing the studied matter in a complex way. Our textbook assumes the reader, who is equipped by the basic knowledge of electromagnetic field, who would like to improve this knowledge and apply it in the solution of practical problems.

The content of the textbook is divided into six main topics if this introduction is not considered. Each topic is subdivided to subchapters. Within each subchapter, the following layers can be found:

The layer A is conceived as a continuous text containing primarily the verbal description of the studies phenomenon. The text is free of complex mathematical expressions and hardly-understandable derivations. The layer is aimed to reveal the matter of the phenomenon as simply as possible. The layer is created for bachelor students dominantly. If the reader is interested in the deeper description, he can follow the link to the second level of the textbook (the layer B).

The layer B describes all the mathematical derivations and their detailed discussions. Even this second layer is conceived as a continuous text, which expects an experienced reader (typically the master student). The chapters, which are thought by authors as relatively simple, contain all the descriptions in the layer A; the layer B presents the same descriptions in English. The reader, who does not understand the English text well, can jump to the parallel Czech version in order to verify his correct understanding of the English text.

The layer C offers the download of the numerical model of the studied phenomenon in the form of m-files of MATLAB. The layer contains a user's description of the numerical model. Thanks to the standard Windows user interface of numerical models, the reader does not need to work with the source code of the model.

The layer D contains the programmer's description of the numerical model. Students can use m-files containing the computational kernel (the code without the user's interface), modify and extend them.

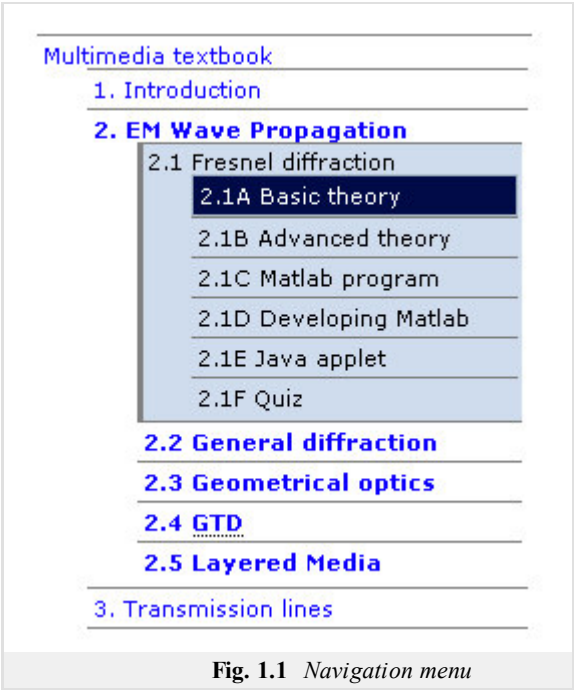

Fig. 1.1 *Navigation menu*

The layer E contains the numerical models of studied phenomena in the form of JAVA applets. The applets can be viewed directly on the webpage without the necessity to buy MATLAB.

The layer F enables readers to test the proper understanding of studied phenomena. In the layer, pentads of questions are available, and the reader is asked to select the correct answer. After answering the pentad of questions, the answers are evaluated. If the question is answered incorrectly (or is not answered at all), the correct answer is displayed. The test is concluded by the complex evaluation.

The authors of the electronic textbook of electromagnetic waves and microwave techniques hope that the textbook becomes a useful tool helping students to understand well principles of examined phenomena. This aim is conditioned by the continuous improvement and completion of its contents, which are based on the recommendations of readers. Therefore, we kindly ask all the readers for their opinion on the textbook,

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for their comments of the form and contents and for their error warnings.

We thank the readers for their help and wish them a pleasant time with the textbook.

On behalf of the authors,

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