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Electronic Information

A Guide to the Web

BY MICHAEL DUNCAN

For scientists and engineers interested in learning about the Web, I can think of no better book than *The World Wide Web for Scientists & Engineers*¹ by Brian J. Thomas. Thomas has a lot of experience writing about computers and the Internet for technical people—a few years ago he wrote the very useful book, *The Internet for Scientists and Engineers*. Much has changed since then, however, and the earlier book was in dire need of updating. Thomas has done that very well in this new book, which was published in January. In it he discusses all of the new capabilities brought to us by Web technology—including Web browsers, publishing, and searching for information—while devoting a large section of the book to a listing, by discipline, of thousands of science and engineering resources available on the Web. Thomas writes with a light, readable, engaging style that makes even the most technical aspects of his book a delight to read. If you only read one book about the Web this year, be sure this is it.

The book is divided into three main sections: essential tools and applications, Web authoring and publishing, and searching and researching on the Web. Each section is further divided into nicely self-contained chapters that discuss specific topics. The level of presentation

throughout the book is at a fairly high level, with surprising depth in many places. In contrast to some books that discuss the Internet, Thomas never talks down to his audience. This is clearly a book written for people used to reading and learning technical information, and Thomas is consistent in orienting his information to users in technological and scientific fields. The book helps you use the Web as a tool for your job—it's not only about designing a personal Web page or figuring out how to use it at home with your family.

Essential tools and applications

In the first section, Thomas starts by talking about getting online (with a discussion that includes which Internet service providers and online services are best for those of us who travel a lot with laptop computers) and how to effectively use e-mail. The section about e-mail is very complete and covers e-mail addressing, etiquette (“netiquette”), attachments, and mailing lists. All examples show how a Web browser can be used as your primary e-mail tool, and Thomas lists a number of Web resources for finding e-mail addresses or discussion lists in your particular area of interest.

The longest chapter in this section is devoted to a discussion of other Web browser features and how to use them. Thomas discusses URLs, browser types, customizing your browser, bookmarks, multimedia (including Java, cookies, VRML, and QuickTime), Usenet discussion groups, helper applications, and plug-ins.

In my opinion, understanding how to effectively use your Web browser is the primary key to suc-

cessfully using the Internet, and Thomas provides more than enough information for you to be able to understand and use the power available in modern browsers.

Web authoring and publishing

In the second section, Thomas goes into a depth that is both useful and refreshing. One chapter has an extended discussion about the common file formats found on the Web, including PDF, PostScript, and a host of image and multimedia formats. He explains clearly how your Web browser deals with different formats and he even makes sense of ASCII versus binary documents.

In the next chapter Thomas briefly discusses some of the current issues that are confronting scholarly publishing on the Web, and then provides a step-by-step guide for creating and publishing a simple Web page. This chapter is a model of clarity and gives a good, general introduction to HTML, the language of the Web. Thomas also goes one step further, providing a chapter on advanced Web publishing. This chapter is particularly outstanding in how well it explains the use of advanced HTML features such as tables, forms, image maps, and background colors. It also touches on the use of Java, cascading style sheets, and CGI scripts. And, of course, it provides pointers to many different Web references and resources related to HTML composition. Overall, this section can be used as an excellent self-contained guide to publishing on the Web.

Searching the Web

The third section of the book is the most useful if you are primarily

interested in using the Web for research. Thomas provides a wealth of information on searching the Internet for material on specific topics. He discusses the different types of tools available on the Internet (search engines and subject guides), how the different search engines rank Web sites, and how to perform searches with simple Boolean operators. He then talks about six of the most popular of these tools (AltaVista, Excite, HotBot, InfoSeek, Lycos, and Yahoo), and gives extended examples of searches using both the HotBot search engine and the Yahoo subject guide.

Finally, as a last part of the final section, but taking up a bit more than half of the total book, Thomas provides a list of science and engineering resource Web addresses. The list, by subject area, includes all of the disciplines you would expect, with the addition of artificial intelligence, energy, imaging technologies, linguistics and natural language, security, and virtual reality. Optics has its own category (Thomas does work for SPIE, after all) and is nicely represented with over 275 links.

Unfortunately, I feel there are some problems with the way the listings are done. For one thing, a large number of the Web addresses do not work. I tested all of the sites listed in "optics" and over 20% of the links caused some difficulty—either the link was dead or I was pointed to a new address. Now, that percentage of problems is not at all uncommon when it comes to Web links. The Web changes rapidly, and Thomas reports links that will be almost a year old by the time you read this. Still, a better-edited list would have stayed more constant. In many cases, it looks like Thomas simply took a scatter-shot approach as to which resources he listed. In addition, a number of less focused sites are included. For example, the "optics" list included a link to NASA's main Web page and to the Office of the Secretary of Defense. Lastly, there is basically no information included with the listed links. There is

nothing to tell you what is at the site or how useful it is. I know it would have been a superhuman editing task to write something about all of the links, but they are definitely less useful without annotation.

On the whole, *The World Wide Web for Scientists & Engineers* is a valuable guide to the brave new world of the Web. It explains the mysteries of the Web, Web browsers, HTML, and search engines. It will help you use e-mail effectively and aid you in designing your own Web page, as well as give you thousands of links to try. As a future improvement to an already fine work, I might suggest that optics societies play host to a live listing of the links mentioned in Thomas' book. Other Web-related books provide this feature and it works very well.

Reference

1. B.J. Thomas, *The World Wide Web for Scientists & Engineers* (SPIE Optical Engineering Press, Bellingham, Wash., 1998).

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Engineering

The Ewald-Oseen Extinction Theorem

BY MASUD MANSURIPUR

When a beam of light enters a material medium, it sets in motion the resident electrons, whether these electrons are free or bound. The electronic oscillations in turn give rise to electromagnetic radiation which, in the case of linear media, possesses the frequency of the exciting beam. Because Maxwell's equations are linear, one expects the total field at any point in

space to be the sum of the original (exciting) field and the radiation produced by all the oscillating electrons. In practice, however, the original beam appears to be absent within the medium, as though it had been replaced by a different beam, one having a shorter wavelength and propagating in a different direction.

The Ewald-Oseen theorem^{1, 2} resolves this paradox by showing how the oscillating electrons conspire to produce a field that exactly cancels out the original beam everywhere inside the medium. The net field is indeed the sum of the incident beam and the radiated field of the oscillating electrons, but the latter field completely masks the former.^{3, 4}

Although the proof of the Ewald-Oseen theorem is fairly straightforward, it involves complicated integrations over dipolar fields in three-dimensional space, making it a brute-force drill in calculus and devoid of physical insight.^{5, 6} It is possible, however, to prove the theorem using plane-waves interacting with thin slabs of material, while invoking no physics beyond Fresnel's reflection coefficients. (These coefficients, which date back to 1823, predate Maxwell's equations.) The thin slabs represent sheets of electric dipoles, and the use of Fresnel's coefficients allows one to derive exact expressions for the electromagnetic

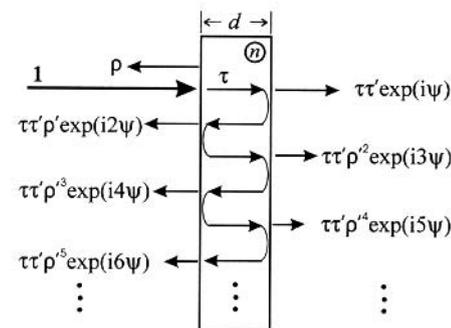


Figure 1. Transparent slab of homogeneous material of thickness d and refractive index n . A normally incident monochromatic plane-wave of wavelength λ_0 suffers multiple reflections at the two facets of the slab. By adding the various reflected and transmitted amplitudes one obtains the expressions for the total r and t given in Eqs. 6 and 7.