This Week's Citation Classic®

Wait J R. *Electromagnetic waves in stratified media.*
Oxford, England: Pergamon Press, (1962) 1970.
[University of Colorado, Boulder, CO]

In many fields of engineering and physics, there is a need to understand how electromagnetic waves interact with solid, liquid, and gaseous media. This book was intended to bring together many of the tools available to predict such behavior. Emphasis is placed on homogeneous materials and layered or stratified structures. [The *SCI*® indicates that the two editions of this book have been cited in more than 990 publications.]

Terrestrial Electromagnetics Explored

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I had the good fortune of working at the elbows of giants early on. Here, I should mention George Sinclair and A.F. Stevenson at the University of Toronto; Arthur Brant at Newmont Mining; Jim Scott at Radio Physics Laboratory, Ottawa; H. Bremmer, Eindhoven; J.A. Ratcliffe and K.G. Budden at Cambridge; Ken Norton, Doug Crombie, and Gordon Little in Boulder; Hans Knudsen in Copenhagen; and, Ronold King and David Chang at Harvard.

My first experience as a radar technician, in the Canadian Army during the latter part of World War II, triggered my curiosity about finding a physical basis for radio wave transmission through complicated, naturally occurring media. Later, after some formal education in applied physics, I was called upon to delve into related problems in electrical prospecting during a pleasant sojourn in Jerome, Arizona (early 1950s), followed by a stint in defense research in Ottawa (until 1955). From there, I was seduced to join the Central Radio Propagation Laboratory, in Boulder, Colorado, where I managed to find a nice niche to expand on my inclinations in wave theoretical physics with reference to long wave radio waves. About this time (1960), the idea came to me to gather some of these investigations into a text that would try to summarize and unify the boundary value approaches that are required to yield acceptable solutions in these seemingly diverse fields. Because of my frequent interactions with experimentalists and engineering practitioners, I found it desirable to cast the analytical results into a form that would be accessible. At the same time, I presented my derivations in such a manner that physical bases were clearly evident, even if the mathematical rigor may have suffered at times. The book arose somewhat spontaneously from these activities, and, no doubt, the visiting professorship in Copenhagen (1960-1961) afforded the opportunity to actually put pencil to pad. The balance of the writing and collating was done in Boulder on weekends during the following year.

I suppose one of the reasons the book has been extensively cited over the years is the convenience to the user in finding such diverse material on electromagnetic waves propped up by a common theoretical base. The frequency range from audio to quasi-optical may have been a selling point. I found it somewhat rewarding to have received so many favorable comments on the book, and, in many cases, I found encouragement to follow up extensions and broaden the field of coverage, including two more texts.[1,2] I certainly should also mention the excellent texts by two old friends, A. Don Watt[3] and the late Janis Galejs,[4] who showed many important applications and expanded on the theoretical foundations, respectively. As a result of extensive numerical efforts by my colleague, Ken P. Spies, in Boulder, we also issued an often used technical note, summarizing many results for very low frequency transmission in the earth-ionosphere wave guide[5] that is still cited in the geophysical journals.[6] Finally, I should mention a recent masterful monograph by Weng C. Chew,[7] who has taken the stratified media formulations to the ultimate limit.

On perusing the current literature on radio wave propagation, light wave and optical technology, acoustics, seismology, and underwater sound, one is struck by the amazing overlap in theoretical techniques to deal with seemingly disparate and physically different areas. There continues to be need to exchange information among workers in these fields. In my text, published almost 30 years ago, I only secured a foothold in this endeavor. The lack of common notation and the specialized mission requirements of the "sponsor" inhibit such generalized studies in this present day and age.

1. **Wait J R.** *Wave propagation theory*. Oxford, England: Pergamon Press, 1981.
2. ————————, *Geoelectromagnetism*. New York: Academic Press, 1982. (Soviet revised edition, Nedra, Moscow, 1987.)
3. **Watt A D.** *VLF radio engineering*. Oxford, England: Pergamon Press, 1967.
4. **Galejs J.** *Terrestrial propagation of long electromagnetic waves*. Oxford, England: Pergamon Press, 1972. (Cited 105 times.)
5. **Wait J R & Spies K P.** *Characteristics of the earth-ionosphere waveguide for VLF radiowaves.* NBS Tech. Note 300, 1964. 130 p. (Cited 120 times.)
6. **Inan U S & Carpenter D L.** Lightning induced electron precipitation events observed at L=2.4 as phase and amplitude perturbations on subionospheric VLF signals. *J. Geophys. Res.* 92:3293-303, 1987.
7. **Chew W C.** *Wave and fields in inhomogeneous media*. New York: Van Nostrand/Reinhold, 1990.

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