AD-A269 033

REPORT DATE

3. REPORT TYPE AND DATES COVERED
FINAL/01 APR 92 TO 31 MAR 93

14. TITLE AND SUBTITLE THE ASUMPTOTIC THEORY OF THE REFLECTION & TRANSMISSION OF A PULSED ELECTROMAGNETIC BEAM FIELD AT A PLANAR INTERFACE SEPARATING TWO DISSPERSIVE MEDIA (U)

6. AUTHOR

Professor Kurt Oughston

6177/DARPA
F49620-92-J-0206

7. PERFORMING ORGANIZATION

University of Vermont
Dept of Mathematics & Statistics
Burlington VT 05405

8. REPORT NUMBER

AFOSR-TR· 03 0623

9. SPONSORING MONITORING AGENCY NAME AND ADDRESS(ES)

AFOSR/NM
110 DUNCAN AVE, SUTE B115
BOLLING AFB DC 20332-0001

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AUG 3 0 1993
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10. SPONSORING MONITORING AGENCY REPORT NUMBER

F49620-92-J-0206

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
APPROVED FOR PUBLIC RELEASE: DISTRIBUTION IS UNLIMITED	UL

13. ABSTRACT (Maximum 200 words)

The long term research goal is to devleop a rigorous analytic formulation and, based upon this, a uniform asymptotic description of pulsed electromagnetic beam-field propagation, reflection, and transmission phenomena in causally dispersive dielectric and conducting media. Emphasis has been placed first on a formulation that is regorously derived from the macroscopic Maxwell's equations with constitutive relations that are appropriate for a homogeneous, isotropic, nonhysteretic, locally linear, temporally dispersive medium, followed by the development and application of the required uniform asymptotic expansion techniques necessary to yield a completely continous description of the space-time evolution of the pulsed beam-field at large propagation distances from the input plane.

93 8 25 025

93-19920

14. SUBJECT TERMS

OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	SAR(SAME AS REPORT)

NSN 7540-01-280-5500

Standard Form 298 Rev 2 89)
298-2

Final Technical Report & Patent Report
(due May 1993)

The Asymptotic Theory of the Reflection and Transmission of a
Pulsed Electromagnetic Beam Field at a Planar Interface
Separating Two Dispersive Media

Kurt Edmund Oughstun, Professor, Principle Investigator
Department of Computer Science & Electrical Engineering
Department of Mathematics & Statistics
The University of Vermont
Burlington, Vermont 05405-0156

Our long-term research goal is to develop a rigorous analytic formulation and, based upon this, a uniform asymptotic description of pulsed electromagnetic beam-field propagation, reflection, and transmission phenomena in causally dispersive dielectric and conducting media. Emphasis has been placed first on a formulation that is rigorously derived from the macroscopic Maxwell's equations with constitutive relations that are appropriate for a homogeneous, isotropic, nonhysteretic, locally linear, temporally dispersive medium, followed by the development and application of the required uniform asymptotic expansion techniques necessary to yield a completely continuous description of the space-time evolution of the pulsed beam-field at large propagation distances from the input plane. A detailed description of the most recent results of this research was recently presented in a talk entitled "Asymptotic Description of Electromagnetic Pulse Propagation in a Linear Dispersive Meeting." by the Principal Investigator at the International Conference on Ultra-Wideband, Short Pulse Electromagnetics at the Weber Research Institute (October 1992). A portion of this research resulted in the following publications (reprints attached if currently available):

K.E. Oughstun, "Polarization Properties of the Freely-Propagating Electromagnetic Field of Arbitrary Spatial and Temporal Form," Journal of the Optical Society of America A, 9 (4), 578-584 (1992).

C.M. Balictsis and K.E. Oughstun, "Uniform Asymptotic Description of Ultrashort Gaussian Pulse Propagation in a Causal, Dispersive Dielectric," Physical Review E, 47 (5), 3645-3669 (1993).

K.E. Oughstun, "Reply to Comments on Pulse Propagation in a Linear, Causally Dispersive Medium," Proceedings of the IEEE (to be published).

K.E. Oughstun and G.C. Sherman,"Asymptotic Theory of Pulse Propagation in Absorbing and Dispersive Dielectrics," (Invited Paper), Review of Radio Science, 1990-1992 (Oxford University Press, to be published).

No patents have resulted from this research.

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