



EEM 323

ELECTROMAGNETIC WAVE THEORY II

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MOTIVATION (TUR)

EEM 224 Elektromanyetik (EM) I dersinde durağan/durgun/statik koşullar altında (yani zaman içerisinde herhangi bir değişikliğin olmadığı durgun ortamda; önce elektrik, sonra da manyetik alanın tanımı, fiziksel özellikleri ve farklı koşullar altında ne şekilde değişeceğini tahmin etme, hesaplama yöntemlerini inceledik.

EEM 323 EM II dersi ise, bir önceki EEM 224 dersinin devamı olarak tanımlanmıştır. Aynı, kaynak kitaplar kullanılmaktadır. Kapsam olarak durgun elektrik ve durgun manyetik alanlar özetlenmekte ve daha sonra asıl kapsam olan ‘zamanda herhangi bir değişiklik olduğunda ne olur?’ sorusuna cevap verilmektedir. Bu değişiklikler ise; yük dağılımının değişmesi, akımın zamana göre artması veya azalması örnek olarak verilebilir. Her iki durumda da temelde artık elektrik ve manyetik alanların ‘durgun’ olduğu kabullenmesi artık yanlış olmaktadır.

Tarihsel önemi olan bu soruyu, bir çok bilim insanı incelemiş ve elde ettikleri sonuçlardan çok etkilenmişlerdir. Özellikle dersimizde çalışmalarını örnekler üzerinden inceleyeceğiz; Faraday, Amper, Kirchhoff ve özellikle Maxwell isimleri ile karşılaşacağız. Einstein’ın en önemli üç kişi olarak fotoğraflarını astığı; Newton, Faraday ve Maxwell olduğu dikkate alınırsa, fiziğin en önemli gelişmelerinin yaşandığı dönemin çalışmalarını birlikte inceleyeceğiz.



WEEKLY SCHEDULE

CLASS PERIODS: Sept. 23, 2013 – Jan. 3, 2014

FINAL EXAM WEEK: Jan. 5, 2013

WEEKLY SCHEDULE: Monday: 13:00 – 13:50

14:00 – 14:50

Thursday: 11:00 – 11:50

12:00 – 12:50

Office hours:*

Monday: 15:00 – 16:50

(*) Any other time, please coordinate.



GRADING BASIS

Homework and Test Policy: There will be weekly homework assignments. These will be due one week from the hand-out date (every following Monday), during the class period. Late homework loses 20% of the grade for that homework per 24 hours, beginning immediately beginning of the first class. There will be one midterm exam and final exam, and possibly several pop quizzes. There is no planned make-up exams.

%10	Homeworks
%10	Quiz
%35	Midterm
%45	Final exam



PREREQUISITES (OPTIONAL)

Courses:

MAT 151 Matematiksel Analiz I
MAT 152 Matematiksel Analiz II
EEM 224 Elektromanyetik I

Skills:

Fundamental algebra
Calculus with complex variables
Programming in Matlab or similar.



WEB PAGES

<http://moodle.midas.baskent.edu.tr> adresinden,

Mühendislik Fakültesi

2013-2014 Güz Yarıyılı

seçeneklerini takip ediniz.

<http://moodle.midas.baskent.edu.tr/course/view.php?id=1286>

Ayrıca,

<http://www.baskent.edu.tr/~gokhuntanyer/>

sayfasında ilave malzeme olduğunda size bilgi verilecektir.



TEXT

Required Text:

- [1] David Keun Cheng, Fundamentals of Engineering Electromagnetics, Addison-Wesley Publishing, Inc., 1993.
veya David Keun Cheng, Çeviri: Adnan Köksal, Birsen Saka, Mühendislik Elektromanyetiğinin Temelleri – Fundamentals of Engineering Electromagnetics, Palme Yayınları.

Supplemental Text:

- [3] David Keun Cheng, Field and Wave Electromagnetics, Addison-Wesley Publishing, Inc. veya David Keun Cheng, Çeviri: Mithat İdemen, Elektromanyetik Alan Teorisinin Temelleri – Field and Wave Electromagnetics, Literatür Yayıncılık.
- [3] Stanley V. Marshall, Richard E. DuBroff, Gabriel G. Skitek, Electromagnetic Concepts and Applications, Dördüncü Basım, Prentice Hall International, Inc., 1996.



OBJECTIVES

When you finish this course you will be able to:

- Understand the physical interpretations of Maxwell's equations
- Get a strong feeling of the meanings of the fundamental electromagnetic equations
- Realize the practical applications of mathematical approximations and see their importance in simplifying 'nature' so that we (simple minds) could try to understand them
- Describe the similarities and the differences between the governing equations for an electromagnetic wave and an optical wave
- Describe 'light' as an electromagnetic wave
- Describe the relationship between light rays and wave fronts
- Calculate water wave displacement on a sinusoid-like waveform as a function of time
- and position
- Describe how electromagnetic waves are similar to and different from water waves
- State the conditions required for producing interference patterns
- Define constructive and destructive interference
- Describe how polarizers/analyzers are used with polarized light,
- Merge your internal understanding of electric and magnetic fields at 0 Hertz to optical waves above ultra-violet at very large frequencies stated in terms of terahertz...
- You would look at your own eyes and binoculars at a different angle.
- and hopefully, enjoy photography more, and you could even become an amateur in astronomy.



TOPICS COVERED

<i>WEEK</i>	<i>FILE CODE</i>	<i>TOPICS (Draft – To be updated)</i>
1	1	Introduction Review (Vector algebra, operators)
2	2	Review (Static electric and magnetic fields) Time-varying fields Faraday's law
3	3	A stationary circuit in a time-varying magnetic field Transformers
4	4	Moving conductor in a static magnetic field Maxwell's equations Differential equations, Integral equations
5	5	Potential functions Solution of wave equations Time harmonic fields, Phasors
6	6	Helmholtz's equations for phasor representations Plane electromagnetic waves Doppler effect
7	7	Polarization of waves Plane waves in lossy media
8	8	MID TERM



9	9	Electromagnetic power The poynting vector Instantenous power density Average power density
10	10	Normal incidence of plane waves at plane boundaries Normal incidence on a good conductor
11	11	Oblique incidence Perpendicular / Paralel polarization Brewster angle
12	12	Transmission lines General TL equations
13	13	TL parameters Wave characteristics of an infinite TL
14	14	Wave characteristics on finite TL Open circuit and short circuit lines Reflection coefficient Standing wave ratio The Smith Chart
15	15	FINAL



INFORMATION ABOUT THE INSTRUCTOR

Instructor: Prof. Dr. S. Gökhun TANYER
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Active research: *Statistical signal processing:*

- Test statistics
- Q-RNG with 'exact statistics'
- Web portal for T-RNG.

Signal processing:

- Time and freq. resolution optimizations.

Antenna design and optimization

Music theory:

- Just-37 interval system for the Turkish Maqam music
- Al-Jurjani's 1,000 year old problem
- Struggle between the octaves and the fifths.



Related Publications:

URL: <http://www.baskent.edu.tr/~gokhuntanyer/>
https://www.researchgate.net/profile/Gokhun_Tanyer

Working Books:

1. 'Nature of music – Sound of mathematics' (in English).
2. 'Müziğin doğası – Matematiğin sesi' (in Turkish).

Working Papers:

3. 'Adaptive desirability function for multi objective design of 2D circular array antennas'.

Optical / Infrared (IR) bands:

4. S. G. Tanyer, C. B. Erol, 'Calibration of the simulation models using limited samples of measured data for the maritime infrared background radiance', Communications Fac. Sci. Univ. Ank. Series A2-A3, 4. 2012.
5. A. Altıntaş, S. G. Tanyer, 'An examination of the effect of polarization on the radiation losses of bent optical fibres,' Optical and Quantum Elect., Vol.25, pp.105–112, 1993.
6. A. Altıntaş, S. G. Tanyer, 'An examination of the effect of polarization on the radiation losses of bent optical fibres,' BILCON'90, Ankara Turkey, Editor:Erdal Arikan, Vol.I, Elsevier, pp.481–487, July 1990.
7. N. Saldi, M. S. Tokay, M. Kucuk, Z. G. Figen, S. G. Tanyer, 'Evaluation of a target recognition algorithm using the sensor model – Sensör modeli kullanılarak bir hedef tanıma algoritmasının başarımının değerlendirilmesi,' 2011 IEEE 19th Signal Processing and Communications Applications Conference (SIU 2011), pp. 706–709, 2011.
8. B. Akyüz, C. B. Erol, S. G. Tanyer, 'Infrared Terrestrial Background Modeling Using MODIS Vegetation Index', International IR Target and Background Modeling & Simulation Workshop, ITBMS'2009, Toulouse, France, 2009.
9. E. Yurdanur, C. B. Erol, S. G. Tanyer, 'Modeling Errors on Maritime IR Background Radiance', International IR Target and Background Modeling & Simulation Workshop, ITBMS'2009, Toulouse, France, 2009.
10. A. Altıntaş, S. G. Tanyer, 'Optik fiberlerde bükülme kayıplarının hesaplanması,' Elektrik Müh. 3. Ulusal Kongresi, Istanbul, Turkey, pp.362–369, Sept. 25-30, 1989.

Radio frequency (RF) band:

11. S. G. Tanyer, A. E. Yilmaz, F. Yaman, 'Adaptive desirability function for multi objective design of thinned array antennas', Journal of



Electromagnetic Waves and Applications 01/2012; Vol. 26, No. 17-18, pp. 2410-2417, 2012.

12. O. T. Altinoz, S. G. Tanyer, A. E. Yilmaz, 'A comparative study of fuzzy-PSO and chaos-PSO', Electroteh. Versnik, (79) (1-2): pp. 68–72, 2012.
13. S. G. Tanyer, C. B. Erol, 'Broadcast analysis and prediction in the HF band', IEEE Transactions on Broadcasting, vol.44, no.2, pp.226–232, June 1998.
14. S. G. Tanyer, Taha Yücel, Selim Şeker, 'Topography based design of the T-DAB SFN for a mountainous area,' IEEE Trans. on Broadcast, Vol.43, No 3, pp.309–316, Sept. 1997.
15. S. G. Tanyer, R. G. Olsen, 'High frequency scattering by a conducting circular cylinder coated with a dielectric of non uniform thickness,' IEEE Trans. on Antennas and Propagat., Vol.45 No.4, pp.689–697, April 1997.
16. A. Altıntaş, O. Ocalı, S. Topçu, S. G. Tanyer, H. Köymen, 'Computer Aided Frequency Planning for the Radio and TV Broadcasts,' IEEE Trans. on Broadcast, Vol.42, No.2, pp.144–148, June 1996.
17. F. Yaman, A. E. Yilmaz, S. G. Tanyer, 'Analysis of the design of the thinned antenna array pattern using the desired function', 2012 IEEE 20th Signal Processing and Communications Applications Conference (SIU 2011), Antalya, Turkey.
18. M. A. Şahin, K. Leblebicioglu, S. G. Tanyer, 'Performance Optimization of Monopulse Target Tracking Radar', 13th Signal Processing and Communications Applications Conference, Proceedings of the IEEE, SiU'05, pp. 49–52, 16-18 May, 2005.
19. C. B. Erol, S. G. Tanyer, 'Estimation of the daily mean ionospheric total electron content using global ionospheric maps', Geoscience and Remote Sensing Symposium, 2002. IGARSS'02. 2002 IEEE International , Vol. 2, pp. 1287–1289, 24-28 June, 2002.
20. C. B. Erol, ; S. G. Tanyer, 'Improved method for the estimation of the ionospheric irregularities by site dependent total electron content (TEC) amplitude fluctuation index', Geoscience and Remote Sensing Symposium, 2002. IGARSS '02. 2002 IEEE International , vol.2, pp. 1290–1292 vol.2, 24-28, June 2002.
21. S. G. Tanyer, B. Baykal, C. B. Erol, "On the use of blind equalization in the HF communication" Proceedings of the IEEE-EURASIP Workshop on Nonlinear Signal and Image Processing, NSIP-99, Vol. 1, pp.159–162, June 1999.
22. S. G. Tanyer, 'High-resolution radar in inhomogeneous media', Signal Processing Proceedings, 1998. ICSP '98. 1998 Fourth International Conference on , vol., pp.381–384 vol.1, 1998.
23. S. G. Tanyer, C. B. Erol, 'Comparison of the current methods for coverage area prediction for communication in the HF band', Antennas and Propagation Society International Symposium, 1998 IEEE, vol.4, no., pp.1888-1891 vol.4, pp.21–26, June 1998.
24. S. G. Tanyer, M. Karaman, I. Öztürk, 'Analysis of wave propagation in inhomogeneous media using FDTD method and its applications', Mathematical Methods in Electromagnetic Theory, 1998. MMET 98. 1998 International Conference on , vol.2, pp.629–631, June 2-5 1998.
25. S. G. Tanyer, M. Karaman, I. Öztürk, 'FDTD analysis for the ultrasonic imaging in the inhomogeneous media - Ultrason görüntüleme sisteminin



homojen olmayan ortamda FDTD yöntemi ile incelenmesi,' SIU-98, 6. Sinyal İşleme ve Uygulamaları Kurultayı, Kızılcahaman, May 1998.

26. A. Altıntaş, H. Köymen, S. Topçu, S. G. Tanyer, O. Ocalı, 'Topography and demography based spectrum utilization in the VHF and UHF terrestrial broadcast bands,' URSI, Lille, France, Aug. 1995.
27. A. Altıntaş, O. Ocalı, S. Topçu, S. G. Tanyer, H. Köymen, 'Computer Aided Frequency Planning for the Radio and TV Broadcasts', NATO AGARD, Digital Communications systems: propagation effects, technical solutions, system design, Athens, Greece, Sept. 1995.
28. S. G. Tanyer, R. G. Olsen , 'High frequency scattering by a conducting circular cylinder coated with a dielectric of non uniform thickness-TE Case', ACES 10'th Annual Review of Progress in Applied Computational Electromagnetics, Monterey CA, Mar, 1994.
29. S. G. Tanyer, R. G. Olsen, 'High frequency scattering by a conducting circular cylinder coated with a dielectric of non uniform thickness', URSI Radio Science Meeting, Ann Arbor MI, June 1993.
30. S. G. Tanyer, 'Elektronik Harp Teknik ve Taktikleri', 6. Savunma Teknolojileri Konferansı (SAVTEK-12), C3 Oturumu, June 20–22, 2012.
31. F. Yaman, A. E. Yılmaz, S. G. Tanyer, 'Analysis of the design of the thinned antenna array pattern using the desired function', 20. IEEE Signal Processing, Communications and Applications Conference, April 18 – 20, 2012.
32. S. G. Tanyer, Davetli Konuşmacı, 'Ülke Bekasında Saklı Kalmış Kuvvet Çarpanlarının Önemi ve Elektronik Harp'in Türkiye'deki Yeri', Savunma Teknolojileri Konferansı (SAVTEK-2010), June 24, 2010.
33. M. Ş. Arslan, S. G. Tanyer, A. Saranlı, B. Baykal, 'Ağ Merkezli Elektronik Harp Kapsamında Veri Tümlleştirilmesi Radar Ağ Sistemi', 3. Savunma Teknolojileri Konferansı (SAVTEK), C3, June 30, 2006.
34. C. B. Erol, S. G. Tanyer, 'Yer Bağımlı Toplam Elektron Miktarı (TEC) Genlik Dalgalanma İndisi ile İyonosferik Bozan Etkenlerin Kestirimi'', 1. Ulusal Kongresi, URSI - Union Radio Science International, Sept. 18-20, 2002.
35. C. B. Erol, S. G. Tanyer, 'Küresel İyonosferik Haritalar Kullanılarak Günlük Ortanca İyonosferik Toplam Elektron Miktarının Tahmin Edilmesi', 1. Ulusal Kongresi, URSI - Union Radio Science International, Sept. 18-20, 2002.
36. Ö. Özgün, S. G. Tanyer, 'Troposferdeki Elektromanyetik Yayılmının Hesaplanmasında Fourier Adımlama Yönteminin Başarımının İncelenmesi', 1. Ulusal Kongresi, URSI - Union Radio Science International, Sept. 18-20, 2002.
37. S. G. Tanyer, B. Baykal, C. B. Erol, 'Yüksek frekans bandında geniş bantlı PSK iletişimi ve kanal denkleştirilmesi,' SIU-99, Proceedings of 7th IEEE Signal Processing and Communications Applications Conference, Ankara, May 1999.
38. Elektromanyetik Enterferans (EMI) ve Elektromanyetik Uyumluluk (EMC), Broadcast Magazine, pp.54–57.

Acoustics:

39. S. G. Tanyer, T. E. Tuncer, 'Kapalı ve yarı kapalı mekanların akustik özelliklerinin bilgisayar ortamında simüle edilerek incelenmesi,' 2. Ulusal Akustik ve Gürültü Kongresi, Turk Akustik Dernegi, Antalya, Oct. 23-25, 1996.



Good luck !...