COMMISSION B (FIELDS AND WAVES) INTERNATIONAL SURVEY ABOUT EM EDUCATION

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ABSTRACT

Commission B has the terms of reference "Fields and waves", which have been well established on the basis of electromagnetism and Maxwell's equations. Experts in this area need a firm basis in mathematics and physics as well as their historical background; though the subjects are sometimes too heavy and time consuming to attract many in the younger generation, one of the urgent missions of Commission B is to foster young talent. With this background, we are conducting an international survey about the state of electromagnetics education. Our plan is to collect information, to analyze the situation, and to report our findings at the URSI General Assembly in New Delhi, October 2005. The Questionnaire was collected by August 1 and is now under the analysis.

QUESTIONNAIRE

Specifically, our objectives are to explore the level, extent, methods, and means of electromagnetics (EM) teaching and education at the university-level. Mostly, we are interested in the Bachelor and Master of Science/Engineering levels at universities and engineering schools. We are aware that educational systems vary quite a bit from country to country and that the degrees that correspond to Bachelor's or Master's degrees may have differences. This is despite the fact that, for example, in Europe there is a trend towards more unification along with the so-called Bologna process.

The questionnaire focuses upon education in Electrical Engineering and/or Physics departments. All URSI Official members for the Commission B have been requested to provide their domestic information regarding this framework of questions. If he is not involved in education, he transfers it to EM colleagues who are involved in and leading EM education in their countries/regions. To make sure the survey is accurate, replies from more than TWO universities are appreciated.

The attached Excel file should be completed and should be sent back by August **1** to mando@antenna.ee.titech.ac.jp.

Questionnaire about EM education

3. Teaching methods.

What type of teaching is included: Choose one or more.

Lectures(L) / problem-solving sessions(P) / laboratory work(W) / student projects(S) / special assignments(A) / multimedia(M).

Example: L, A and M

4. How much web-based teaching is included?

If www is used at all, Choose (I), (A)and/or (P).

(I) as an information channel to students ? (A) animations/applets to illustrate dynamic fields ? (P) pure virtual web courses without any contact teaching ?

Example: I and A (http://www.xxx.yyy)

5. Commercial software

Do the students use commercial or free software in the course, for solving EM problems or understanding the phenomena ?

If YES, what types ? Choose (S1), (S2), (S3). and/or (S4).

(S1) Commercial software (EM solvers: HFSS, Ansoft Designer[Ensemble], NEC, SuperNEC, IE3D, FEKO, Momentum, S-NAP, FIDELITY, MW-Studio[MAFIA], SPICE)

(S2) Commercial software (Education/Animation/Presentation: Mathematica, Maple, MATLAB, Mathcad, PowerPoint, Visual BASIC, Visual C++, etc)

(S3) Free software (Education/Animation/Presentation: LiveGraphics3D, JavaView, Java SDK)

(S4) Others

Example: (S1)NEC, (S2)MATLAB

6. Grading.

How does the student pass the course? Choose (E), (P) and/or (W).

Exam (E) / exercise points (P)/ independent work (W)

Example: E and P

7. Useful experiences and difficulties in EM education

1) Based on your experience in teaching electromagnetics, have you found any novel/innovative methods or tools that have helped the students a great deal? Would you like to share some of those experiences with others?

2) Have you found any problems or difficulties with respect to teaching certain concepts and found some unique solutions that would help others?

Please explain your experiences to share with people.

Please indicate the above for each EM related subject/topic listed below, if any in the curriculum.

<Mathematics>

M1 Mathematics (Vector analysis)

M2 Mathematics (Linear algebra)

M3 Mathematics (Fourier/Laplace Transforms)

M4 Mathematics (Differential equations)

M5 Mathematics (Integral equations)

M6 Mathematics (Statistics)

<Electromagnetic theory>

E1 Electromagnetism (Static)

E2 Electromagnetic waves (Frequency domain)

E3 Electromagnetic waves (Time domain)

E4 Boundary value problems (Canonical problems, special functions)

E5 Boundary value problems (Numerical methods: MoM, FEM, FDTD)

<Systems/Components and application>

C1 Wireless Communications / Communication Systems

C2 Digital/Analogue Communication, Modulation

C3 EM Components (Antennas, wave guiding structures)

C4 Propagation and scattering

O1 Others (write in)

INITIAL RESULTS OF THE SURVEY

More than 20 Universities answered to the Questionnaire as of August 1 and some are still arriving. They are now being analyzed and some of the observations are as follows.

- ✓ Most of the undergraduate students take the Electromagnetism in the 1st or 2nd year.
- ✓ Statistics are usually optional and are not required.
- ✓ Electromagnetic waves are provided in the 2nd year.
- ✓ Boundary value problems start around the 3rd year.
- ✓ Digital/Analogue Communication is often required in the 2nd year.
- ✓ EM Components (Antennas, waveguides) are provided in the 2nd and the 3rd year as an optional.

Detailed analysis will be conducted and presented in GA.