01 Jan 1971

Industry Participation In Electrical Engineering Education-extra High Voltage Laboratory

J. Derald Morgan
Missouri University of Science and Technology

Recommended Citation

J. D. Morgan, "Industry Participation In Electrical Engineering Education-extra High Voltage Laboratory," *Proceedings of the IEEE*, vol. 59, no. 6, pp. 987 - 988, Institute of Electrical and Electronics Engineers, Jan 1971.

The definitive version is available at https://doi.org/10.1109/PROC.1971.8301

Industry Participation in Electrical Engineering Education—Extra High Voltage Laboratory

J. DERALD MORGAN, SENIOR MEMBER, IEEE

Abstract—A unique electrical engineering laboratory course is described. This laboratory is an example of how industry can cooperate with universities in engineering education. The organization and operation of the course as well as the course material is outlined and explained, including the ways in which the industry participates in the operation of the laboratory.

The educational benefits derived from such a cooperation between industry and the university are briefly detailed. These benefits are extended to the student, the University, the faculty, and the participating industry. This article provides the framework on which other laboratory experiences could be conceived and developed where industry and the university cooperate in the laboratory course.

I. Introduction

MUCH criticism is leveled at engineering education for providing too little exposure to laboratory testing and the latest in equipment and methods of testing. This is a valid complaint, but in many cases it is financially impossible for the university to provide facilities, instruments, and samples of the latest equipment for test without support by industry. It would be financially unsound for the university to build certain types of laboratories because of their limited use and high capital investment. The extra high voltage (EHV) laboratory falls in this category. However, the course material is important to those students interested in the power industry.

In another paper in this issue [1], Woodson, Schweppe, and Wilson point out the importance of power systems engineering education in a modern electrical engineering curriculum, and the need for close university–industry ties. The program to be described in this paper provides these ties and gives students a unique experience on modern power system equipment not now in any other university.

This electrical engineering laboratory experience is an example of industry participation in engineering education to their mutual benefit. The course described in this paper is entitled "Extra High Voltage Laboratory," and it has been developed for University of Missouri—Rolla students through the mutual cooperation of the A. B. Chance Company and the University of Missouri—Rolla, Electrical Engineering Department.

II. The Laboratory Facility

The A. B. Chance Company occupied its new F. Gano Chance Engineering Research Center and its associated testing laboratory complex in 1960. This laboratory complex includes mechanical, environmental, short circuit, and high voltage laboratories.

The power source for the short circuit laboratory is a 762 MVA short circuit generator. The key items of equipment in the high voltage laboratory are a 2400- kV impulse generator and two cascaded 60-Hz transformers.

Manuscript received October 1, 1970; revised January 11, 1971.
The author is with the Electrical Engineering Department, University of Missouri—Rolla, Rolla, Mo. 65401

III. Course Organization

Each experiment is divided into four basic parts:

1) preparatory lecture;
2) work session at the A. B. Chance Company test facility;
3) review of the work session;
4) formal engineering report.

The preparatory lecture is held on the campus where the students are introduced to the theoretical aspects of the tests to be run during the next work session. The applicable standards are passed out to the students, and the test procedures described by the standards are discussed. Circuit diagrams for each type of test are given to the students, as well as the circuit and specifications for the test equipment to be used in the experiments.

The day long work session at the A. B. Chance test facility consists of two parts. The first is a lecture in which the Chance engineers discuss the theoretical and practical aspects of the tests to be performed. Operation of the equipment is explained in addition to the problems encountered in performing each test. The second part of the day is used to run the set of scheduled tests.

Following each work session, the students meet again with the professor for a review of the test results. Questions concerning all parts of the tests are answered.

A formal engineering report is required of each student. This report includes a discussion of the theory, the test procedure, and test results.

IV. Course Material

The course begins with an introduction to the appropriate U.S.A., IEEE, ANSI, American National, and NEMA Standards. Other material includes equipment specifications on the test equipment from Haefely production bulletins, equipment specifications from A. B. Chance on the devices to be placed under test, and Bureau of Standards publications. Outside reading is assigned from several IEEE articles and selected texts.

The tests that are made during each of the four work sessions are outlined below.

A. First Work Session

1) calibration of laboratory instrumentation;
2) 60-Hz voltage withstand for a string of suspension insulators;
3) impulse flashover for a string of suspension insulators.

B. Second Work Session

1) interrupting test on a 15-kV fuse cutout;
2) dielectric tests on a 15-kV fuse cutout;
   a) 60-Hz dry-withstand voltage test;
   b) 60-Hz wet-withstand voltage test;
   c) impulse-flashover voltage test.

C. Third Work Session

1) the safe use, testing, and operation of a Pitman "Hotstik" truck is demonstrated and performed;
2) during the remainder of the day the A. B. Chance manufacturing facilities are visited.

D. Fourth Work Session

1) demonstration of corona effects;
2) measurement of radio interference voltage for suspension insulators;
3) measurement of radio interference voltage for a primary terminator.

V. Educational Benefits

The operation of this laboratory has proven to be of benefit to the students, the university, the faculty, and to the A. B. Chance Company, the sponsoring industry. The evaluation of the benefits derived from industry–university cooperation is presented in the following paragraphs.

The student benefits educationally by being able to test equipment that represents the latest industry developments. He is also able, in this laboratory, to do his testing in a uniquely well-equipped laboratory with a professional staff of industry engineers. Experience has shown that this greatly enhances his interest and consequent learning.

The university benefits, as described earlier, by having available for the cost of transportation a sophisticated laboratory which represents a prohibitively large capital and maintenance expense.

The faculty is able to enrich their classroom teaching with examples and discussions drawn from this laboratory experience. They also benefit from their professional associations and discussions with the staff of the cooperating industry. A rapport between the university and the industry is an important result of the faculty and student visits.

The short term gain of the cooperating industry is primarily the rapport established with the university, the faculty, and the students. Long term gains are more significant. Industry can satisfy itself that some students have had the equipment and testing exposure they have been suggesting is desirable and needed. Furthermore, future employees of the industry are more likely to be drawn from students who have had a prior knowledge of the industry.

Acknowledgment

The author wishes to thank Mr. Fry, Manager of Engineering, and Mr. Staley, Supervising Test Engineer, of the A. B. Chance Company, and Prof. McPherson of the University of Missouri—Rolla, for their help in developing this laboratory. The laboratory course as outlined here has been expanded, and the Columbia campus of the University of Missouri is now participating with Rolla in the laboratory.

References

[1] H. H. Woodson, F. C. Schweppe, and G. L. Wilson, "Electric power systems engineering education in a modern curriculum," this issue, pp. 860–868.

An Undergraduate Instructional Laboratory Program in Communications

AUBREY M. BUSH, MEMBER, IEEE, AND ROGER P. WOODWARD, MEMBER, IEEE

Abstract—An undergraduate laboratory program in communications principles which is under development by two members of the faculty at Georgia Institute of Technology, Atlanta, Ga., is described. The laboratory program is designed to illustrate basic principles without overwhelming the student with circuit and hardware problems. Equipment used centers around a "communications simulator." The simulator, associated instrumentation, and the laboratory program are discussed.

Introduction

Communications studies can be conveniently divided into three categories: circuit aspects, practical system aspects, and theoretical aspects. Circuit aspects deal with the detailed design of individual subsystems, practical system aspects with the detailed design of interconnections of these subsystems, and theoretical aspects with the functional or "block-diagram" design of an overall system.

The circuit aspects probably are best treated from the point of view of circuits courses, while the practical system aspects probably cannot be adequately treated in an undergraduate laboratory environment. The theoretical aspects, however, are abstract, and a laboratory experience demonstrating the principles is very worthwhile.

In this paper we describe a laboratory program designed to illustrate basic principles without overwhelming the student with circuit and practical system aspects of communications. This is accomplished by using a frequency range of 0–1 MHz, rather than HF, VHF, or microwave frequencies. Commercial equipment is used wherever possible, but since some functions are not normally performed in this frequency range, and others are not available in simple instruments, it has been necessary to design a unit that we call a "communications simulator." This simulator, together with commercially available signal generators, storage oscilloscope, spectrum

Manuscript received October 2, 1970. This work is supported by the National Science Foundation under Grant NSF-GY-8152.

The authors are with the School of Electrical Engineering, Georgia Institute of Technology, Atlanta, Ga. 30332.