

Enhancement of the Learning Experience of Foreign Graduate Exchange students and Visiting Scholars

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George Karady (SM'70, F'78) was born in Budapest, Hungary. He received his BSEE and Doctor of Engineering degree in electrical engineering from Technical University of Budapest in 1952 and 1960, respectively. Dr. Karady was appointed to Salt River Project Chair Professor at Arizona State University in 1986, where he is responsible for the electrical power education and performs research in Power Electronics, High Voltage Techniques and Electric Power. Previously, he was with EBASCO Services where he served as Chief Consulting Electrical Engineer, Manager of Electrical Systems and Chief Engineer of Computer Technology. He was Electrical Task supervisor for the Tokamak Fusion Test reactor project in Princeton. From 1969 to 1977 he worked for the Hydro Quebec Institute of Research as a Program Manager and in 1976 was elected to Research Fellow. Between 1952-1969 he worked for the Technology University of Budapest where he progressed from Post Doctoral Student to Deputy Department Head. In addition, Dr. Karady worked as visiting lecturer/professor in England and in Baghdad, Iraq. Between 1980-86 he served as an Adjunct Professor of the Brooklyn Polytechnic Institute. Dr. Karady is a registered professional engineer in New York, New Jersey and Quebec. He is the author of more than 300 technical papers.

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Dr. Karady served in the US National Committee of CIGRE as Vice president and secretary treasurer. He was a member of the Canadian Electrical Engineering Association and the Electrical Engineering Association of Hungary, where he held different positions between 1952-1966.

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SUMMARY

This paper reviews the education programs developed at Arizona State University for semester-long and year-long foreign exchange students in Power Systems. Two programs are described and evaluated in this paper. For semester-long exchange program, students are offered tutorials, laboratory experiments and research instructions. For year-long exchange program, students are more involved in the research work.

I. INTRODUCTION

Arizona State University (ASU) is a global university enjoying a top rank consistently among universities in the U.S. Currently, 9,000 students representing more than 132 countries benefited from the international educational programs at ASU. Targeted programs are designed and developed appropriately at ASU to provide international students with extraordinary experience in both culture and advanced technology. As a part of ASU, School of Electrical, Computer and Energy Engineering welcomes and invites international exchange students in both semester-long and year-long programs.

Many universities have developed specialized educational programs for the U.S. students studying abroad. [1] gives an example on the school level about how to initialize and set up a study abroad program for undergraduate students. The paper discussed the concerns of cost, culture, and learning flexibility. [2] - [4] describes successful implements of study abroad programs for undergraduate level US students. [2] points out that short-term summer-based program is more targeted on cross-culture benefits. [3] emphasizes the importance of faculty involvement in the success of semester-long engineering study abroad programs. The key contribution of [4] is that they provide exchange engineering students experimental experience besides classroom experience.

However, most of the practice of engineering study abroad programs concentrates on undergraduate students. Statistics data shows that the number of graduate-level visiting scholars rises significantly in these years. The teaching strategy for undergraduate students is not proper for them because the education for graduate students requires both advanced courses and research. The students must learn the research methods, like literature review, computer-based simulation techniques, and analytical skills.

This paper introduces two teaching models for graduate level visiting scholars in semester-long and year-long programs in ASU respectively. In the following parts, Section II introduces the motivation and goal of two visiting scholar programs. Section III describes the educational model we implied for visiting scholars in both programs. Section IV gives an evaluation of the educational models. Finally, Section V concludes the paper.

II. PROGRAM MOTIVATION AND GOALS

School of Electrical, Computer and Energy Engineering at ASU currently has two programs for visiting scholars. The first program is semester-long and is exclusively for Pakistani graduate level visiting students. The second program is year-long and open for visiting scholars from all over the world.

Case 1: Semester-long abroad study program

Arizona State University (ASU) is involved in a program called U.S. – Pakistan Center for Advanced Studies in Energy (USPCAS-E), founded by US AID. US AID is a lead U.S. Government agency that works to “end extreme global poverty and enables resiliently, democratic societies to realize their potential” [5]. The major goal of USPCAS-E is to “focus on applied research relevant to Pakistan’s energy needs and serve as a bridge between the government, industry, and academia and undertake sustainable policy formulation” [6].

The USPCAS-E program started to send exchange students from August 2015 and has been continuing for two semesters. More than 60 Pakistani graduate students had spent a semester at ASU to carry on energy-specific research. The graduate exchange students come from two leading Pakistani universities; the National University of Sciences and Technology (NUST) and the University of Engineering and Technology (UET).

In the last two semesters, a total of 13 exchange students came to the power systems laboratory to study commercial devices and software used in the U.S. energy industry. Further, as graduate students, they also learned major steps in doing research.

Case 2: Year-long abroad study program

Arizona State University accepts J-1 visiting scholars for temporary education. The aim of the exchange program is to provide foreign students opportunities to experience the way of life and schooling in America. At the end of the program, the participants are expected to return to their home countries to utilize the experience and skills they have acquired while in the United States. [7]

Most of the J-1 visiting scholars are Ph.D. candidates in year-long programs. This paper will take a Chinese visiting scholar as an example. The Chinese visiting scholar is a Ph.D. candidate in a year-long exchange program sponsored by the China Scholarship Council (CSC). He was under the direct instruction of a professor to enhance his research skills and participated in two on-going projects at Power Systems Laboratory.

III. EXAMPLES OF PROGRAM CONTENT

Visiting scholars from varied programs should be treated differently based on their educational background, visiting objectives, and the duration of studying. A short-term program needs more designed lectures and experiments to assist students to gain more knowledge of advanced technology. On the other hand, a long-term program for the Ph.D. candidates may be more flexible and research-based, aiming to promote the existing work of the students.

Case 1: Semester-long graduate level visiting students

The course designed for Pakistani visiting scholars consists of three parts, including lectures, experiments, and research work. The three parts work together to help students to gain analytical skill as shown in Figure 1. The experiment platform is shown in Figure 2.

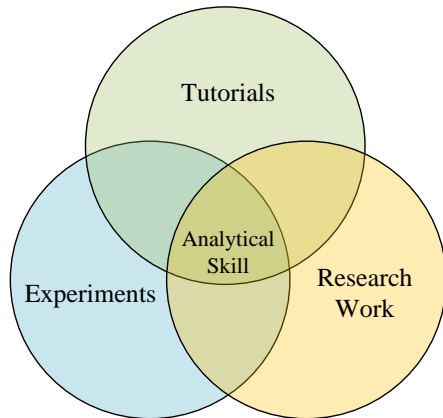


Figure 1 Course elements



Figure. 2 Platform for digital relay experiments

A. Tutorials

The tutorial is one of the widely accepted instructional methods for a group of students. A well-organized tutorial can help students to absorb new knowledge quickly in a logical manner. This characteristic of tutorial makes it an effective way to teach Pakistani students the basic knowledge which they didn't have access to in Pakistan.

Power systems laboratory designed and organized specific tutorials for the students in the USPCAS-E program. The tutorial covers four portions, including the classic power system protection schemes, the operation of digital relays, the design of the smart grid, and the PSCAD simulation. Each portion is introduced and discussed in four one-hour lectures.

Four projects are carefully designed for each portion of the tutorial. The exchange students need to use the knowledge covered in the tutorial to finish the corresponding projects. Students are also required to submit project reports as references for evaluation.

B. Laboratory Experiments

Laboratory experiment helps students gain hands-on experience; as well as to enhance students' ability to convey abstract concepts into real life practice. Power Systems Laboratory provides the Pakistani exchange students with digital relay experiments to enable them to imply the knowledge taught at ASU in their hometown. [8]

Three laboratory experiments are designed for (time delay) over-current protection, directional protection, and differential protection respectively. Students will receive laboratory manuals one week before the experiments. The manual illustrates objectives, step-by-step operating procedures, and expected outcomes of each experiment. Typically, three students are assigned to a group during the three-hour laboratory exercise. Students will learn connections of the protection systems, digital relay settings, and analysis skill practically. Experiment reports are also required as an evaluation material.

C. Research work

The students are also involved in the ongoing research studies at ASU. Each student is required to select at least one research topic they are interested in at the Power Systems Laboratory. Then they will follow the graduate student associated with the specific topic to learn skills to do research work, such as literature review, modeling, and programming.

D. Evaluation

Evaluation puts students under pressure to study and can enhance the learning experience of the exchange students. The evaluation for Pakistani students consists of four parts. As shown

in Figure 3, we evaluate students' performance of participation, reports and assignments, research work outcomes, and the individual presentation at the end of the semester.

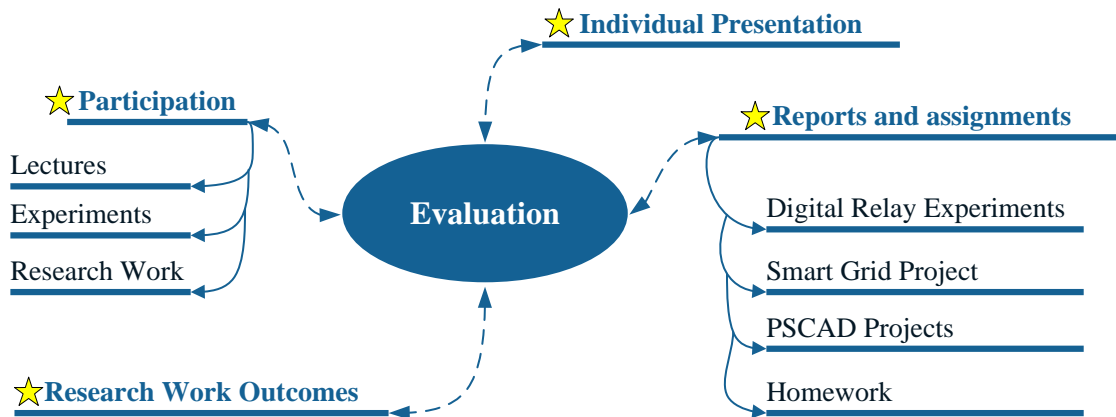


Figure 3 Evaluation scheme for the exchange students in the USPCAS-E program

The participation grade is based on how active a student is in tutorials, laboratory experiments, and research work. The grades of students' performance in laboratory experiments and project are based on the corresponding reports, including three digital relay experiments reports, smart grid project report, two PSCAD project reports and homework solution.

Case 2: Year-long graduate level visiting scholars

The Chinese visiting scholar does not need to attend any courses at ASU since he is in his last year of the Ph.D. program. The main educational goal for him is to enhance his research skills. So he is assigned to work with ASU graduate students on research projects related to his previous research work. This cooperation was concluded with reports and joint paper submitted to international conferences.

An example of the research work is the simulation study using PSCAD to identify the transients in the solid state transformers (SST). [9] This is an insulation coordination because the SST are connected directly to the distribution network (15 kV). The lightning strike can destroy the SST. The study developed a method to prevent SST failure. Figure 4 is the simulated system in PSCAD. Figure 5 is the draft design of a testing platform for the impulse test on SST.

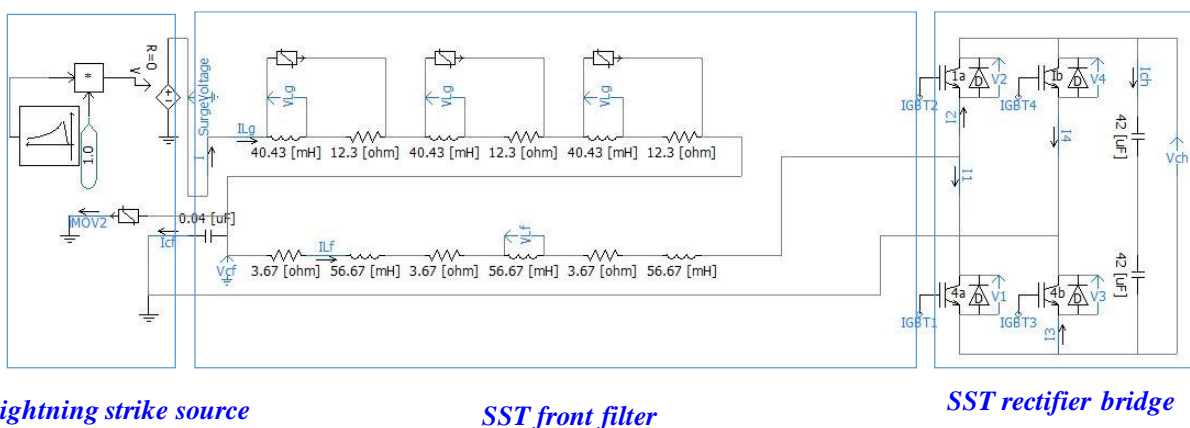


Fig 4 Simulation model built using PSCAD

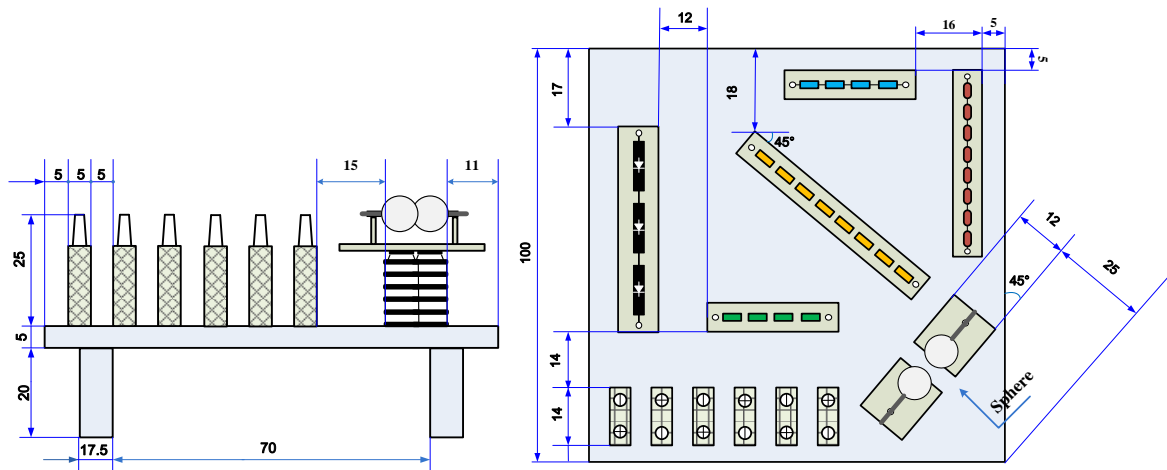


Fig 5 The designed drafts of testing platform

IV. ASSESSMENTS OF THE PROGRAM

Case 1 semester-long graduate level visiting students

The USPCAS-E programs have launched for two semesters. Total of 13 Pakistani exchange students came and studied at the power systems laboratory. At the conclusion of their program, the students took a survey and left valuable feedback to help improve the semester-long exchange program. The program plan was adjusted in the second semester taking consideration of both the performance and the feedback from the students in the first semester. Table 1 summarizes the changes of the program plan between the two semesters.

Table 1 The Comparison of Program Content between the first and second semesters

	Tutorial	Laboratory Experiments	Research Work	Presentation	Projects and HW	ASU Courses
1st Semester	√	√			√	√
2nd Semester	√	√	√	√	√	

In both semesters, students were expected to attend tutorials, perform laboratory experiments, and finish assigned projects and homework. Through these procedures, students can develop simulation skills and gain digital relay operation experience. It is important to provide the exchange students with the tutorials, projects, and experiments; because the simulation programs and digital relay devices are not available in students' home universities.

An easily overlooked step in the graduate level exchange program is to release program plan before the students' coming. Since graduate level students normally have a specific area of study, this step can help students to avoid major mismatch. For example, in the first semester, a majority of students failed in selecting apposite program due to the lack of information about the power systems laboratory.

Another improvement that we made is to replace regular ASU courses by teaching students about how to do research work. The outcome of this change is satisfactory as the students in the second semester submitted one IEEE conference paper and co-authored one IEEE conference paper.

The evaluation of the students' performance consists of four parts as mentioned in Section III. The exchange students may be in different grade levels. It is worth noting that the evaluation for the first-year graduate and third-year graduate exchange students should be graded separately. In the second semester, both the student's satisfaction and performance in the exchange program improve significantly.

Case 2 year-long graduate level visiting scholars

The long-term exchange visitor program at ASU consists of two scholar types, including professor and research scholar, Ph.D. and Postdoctoral researcher. In this sample case, the exchange scholar is a Ph.D. candidate at Chongqing University, China.

As a Ph.D. candidate, he possesses the ability to conduct research under minor instructions. Besides, he has shown more enthusiasm and interest in working with students on the ongoing projects at ASU compared with visiting professors. While included in the project at ASU, the visiting scholar still needs to finish his thesis under the remote instruction from the advisor at his home university.

The experience of participating in the project at ASU benefits both the visiting scholar as well as our laboratory. On the one hand, the visiting scholar expands his research area as well as learns advanced technologies and simulation software. The multi-culture educational environment at ASU broadens his horizon and provides him wider opportunities of future career. On the other hand, his joining the project accelerated the research process and improved the academic communication between two universities.

The studying experience of the graduate level visiting scholars can be improved by developing effective communication between the professors in both the sending and the accepting universities.

V. CONCLUSION

The exchange graduate students are always undervalued, especially engineering students. Properly organized program can help these students to enhance their learning experience abroad. On the other hand, exchange students should be aware of the research area of the foreign university. A similar background helps to enhance the efficiency of studying abroad.

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