Project 2

Applications of Load-Pull Systems in Transmission Lines. Expanding knowledge in TL parameters and calculation techniques using peer reviewed technical literature

The journal paper by M. H. Hashmi and F. M. Ghannouchi, titled "Introduction to Load-Pull Systems and their applications" published in IEEE Instrumentation and Measurement Magazine, 1094-6969, pp. 30-36, in February, 2013 is assigned for review to all students in the TCET 2220 course. The topic of the article is suitable to the course level and presents applications of Load-Pull systems used in elements present in transmission lines (TL). By reading this article the students are exposed to further applications of the Smith chart, reflection coefficients and impedance matching methods. This system has been used in the transmission line field for more than 4 decades and is still the preferred method for measuring the optimal transistor parameters used in power amplifiers in networks. This project is assigned to students after covering transmission line parameters and Smith chart in class.

TAC/ABET Student Outcomes assessed by means of this project:

3f. ***An ability to apply written, oral, and graphical communication in both technical and non-technical environment; and an ability to identify and use appropriate technical literature;***
3g. ***An understanding of the need for and an ability to engage in self-directed continuing professional development;***
3h. ***An understanding of and commitment to address professional and ethical responsibilities, including a respect for diversity***
3i. ***A commitment to quality, timeliness and continuous improvement;***

This assessment is focused on the outcomes above but it can also be used for assessing outcomes: 3a (Performance Indicators 1 and 4), 3b (Performance Indicators 1), 3c (proj) (Performance Indicators 1 and 4), 3d(All Performance Indicators), 3h(All Performance Indicators)

Assignment	**Assessment of TAC/ABET Student Outcome**	**Assessment Strategy**
The students will need to read the paper thoroughly and prepare a report which does not have a standard format. It is more like a one page summary in which students will reflect on the paper and answer the scaffolding questions. The students need to prove good knowledge and use of sentences structures as well as correct use of the technical terminology.	3f-2 Students use correct English language grammar, spelling and punctuation. 3i-1. Present a professional attitude with respect to class assignments, submitting reports and projects in a timely fashion 3i-2. Prepare and submit assignments of professional quality	3f-1 Direct: LDE & Rubrics Indirect: Exit Survey 3i-1,3i-2, 3h-2,3h-3 Direct: Rubrics Indirect: Exit Survey

	3h-2 Students understand and demonstrate ethical responsibilities 3h-3 Students form diverse lab/project teams respecting all ethnical backgrounds and display respect for diversity and tolerance.	
This assignment requires the students to have a clear understanding of the transmission line elements and parameters as well as Smith chart use in the calculation of these parameters. To help them with writing a clear and meaningful reflection piece a few scaffolding questions are posted. Here are some of these questions: 1. Where would you use a Load-Pull System on a TL? 2. How would this system help one improve the transmission on a TL? 3. How do you see this paper in the context of this course? **This type of questions will also be asked in the LDE (Local Developed Exam)**	3f-3 Students provide appropriate discussions, conclusions and recommendations. 3f-4. Students identify and use appropriate technical literature. 3g-1 Students are able to effectively use library and online resources. 3g-3 Students form diverse project teams respecting all ethnical backgrounds and display respect for diversity and tolerance. (Rubrics)	3f-3,3f-4 and 3g-1 Direct: LDE & Rubrics Indirect: Exit Survey 3g-3 Direct: Rubrics Indirect: Exit Survey
Students will present their reflections during a discussion session in the class	3f-5 Students are able to organize and plan communication/ presentation 3f-6 Students display a professional appearance and are able to provide good oral delivery	3f-5, 3f-6 Direct: Rubrics Indirect: Exit Survey

Complete list of scaffolding questions:

Note: The questions below are meant to help the reader in preparing a report about the assigned paper, however under no circumstances one should limit himself/herself to the questions below. The inclusion of additional comments to the paper is highly recommended.

1. Where would you use a Load-Pull (LP) System on a transmission line (TL)?
2. How would this system help one improve the transmission on a TL?
3. How do you see this paper in the context of this course?
4. How did this paper impact your understanding of the Smith Chart?
5. Which reference did you find most useful in clarifying unknown terms or concepts discussed in the paper?
6. What are the main differences between active and passive load pull systems.
7. What are the draw backs of closed loop passive load-pull systems and active load pull systems and how have these issues been recently addressed in the recent advances on these systems.

8. How do you explain the presence of oscillations in the closed loop structure of the load pull system? How were these oscillations overcome? What is the name of the new system design that addresses these oscillations in an LP system?
9. What is a hybrid LP?
10. When and why are the quarter wave transformers used in conjunction with LP systems? What is the function of a λ/4 transformer in this set up?
11. What are the similarities and differences between a Klopfenstein transformer and a λ/4 transformer?
12. Describe the latest advances that allow for higher Γ using the pre-matched LP system.
13. What are the two latest developments in load pull configurations presented in this paper?
14. Suggest at least one more reading in Load Pull systems and one in Smith Chart applications in TLs.