

## Phase-Locked Loops

**Acknowledgements:** Developed by Laura Marmolejo, Faculty of Austin Community College, Austin, Texas.

**Time Required:** Approximately 2 hours classroom and 2 -3 hours outside the classroom

### **Equipment & Tools**

- Internet connection
- Standard browsing (web surfing) capabilities
- Technical magazines
- Technical textbooks

**Team Activity:** Each team of 3-5 students will research one of three topics, and then compile and present their findings in an oral report with handouts of findings to the class.

### **Learning Objectives**

1. Use the Internet to gather and organize information about phase-locked loops and applications.
2. Research vendor websites and determine phase-locked loops specifications for various chips.
3. Investigate the use of phase-locked loops in frequency synthesizers.

### **Performance and Task Procedures**

1. Each team will research one of the following topics:  
Topic #1: PLL Manufacturers' Websites  
Topic #2: Use of PLL's in Other Applications  
Topic #3: Different Types of Frequency Synthesizers
2. Develop a Research Plan for delegating tasks such locating as organizing information, and developing a format for the oral presentation and handouts to the class. The following suggestions can be used to formulate a Research Plan:
  - a. Decide when and where to meet to research the topic and prepare the presentation (1-3 hours).
  - b. Assign the following work tasks based on individual strengths:
    - i) Investigator: The investigator should be the most proficient in doing Internet research. S/he will conduct the Internet searches with the guidance of the team member who is responsible for the target topic or research question to be answered.
    - ii) Organizer: The Organizer builds a list of keywords for the Investigator to use as the research is conducted. The Organizer gathers results on each subtopic or question within the target topic assigned to the team. S/he discusses the results with the Investigator to ensure the team has enough facts to adequately convey the information to the other class members.



- iii) Report Writer: The Report Writer takes the results of the Organizers notes, printouts, and any other information collected and places it in a structured format with the help of the Presenter (described below). (If possible, use a Microsoft PowerPoint presentation or similar application for the oral presentation.) Develop printed handouts and/or visual aids that summarize the main findings of the research and can be shared with the class.
  - iv) Presenter: The Presenter works with the Report Writer to build the presentation, then presents the report to the class but may call on individuals within his/her team to help explain findings as appropriate.
3. Meet as a team and gather the information:
- a. The Investigator and Organizer begin the searches using search engines such as Google.com or Yahoo.com. They pass information to the Report Writer as each research question is answered or each subtopic is addressed. It is important for the Investigator to share his/her search strategies and methods so that other team members learn from the Internet activity and are able to conduct their own searches in the future.
  - b. Each team member should provide his/her input: Provide suggestions on how the Organizer collects and arranges the material; Provide tips to the Report Writer on how the material can best be summarized and explained and help develop the handouts; Provide ideas to the Presenter on the arrangement of the material in the presentation and how to emphasize certain key points to the audience.
4. Plan for a 15 minute oral presentation to the class with at least five minutes to answer questions and explain the research process the team employed. The last few minutes of the presentation should be reserved for discussing how the team was organized, tasks delegated, and ideas on how best to work within a team structure. (This discussion can be lead by each individual team or be an overall class discussion.)

### **Topic #1: PLL Manufacturers**

- 1. Find at least three manufacturers' web sites for phase-locked loops and related chip technology.
- 2. Select a specific PLL chip from each manufacturer. Find the specification sheet for each selected PLL chip and download the data sheet.
- 3. Determine key specifications such as frequency range of the VCO and chip response time.
- 4. Enter the information in the table at the end of this Drill Down identifying the manufacturers, the chip part number, specifications, and key differences between each manufacturer's PLL chip.

### **Topic #2: The Use of PLL's in Other Applications**

- 1. Identify at least one new application in which a phase-locked loop is used. The application selected should be one not previously mentioned in the PLL module.
- 2. Find and compare information from two different websites which discuss the same application.
- 3. Summarize the purpose and function of each phase-locked loop application.



**Topic #3: Different Types of Frequency Synthesizers**

1. Identify three different types of frequency synthesizers, and search the Internet for more information on each type.
2. Identify the main differences between the frequency synthesizers including design, physical, and operational differences.
3. Summarize the differences by defining the purpose, function, advantages, and disadvantages of each frequency synthesizer.

**Deliverables:** Each group should prepare an oral presentation of their findings to their class. The presentation should be professional as if presenting to a group of engineers or technicians.

**Scoring or Grading Criteria:** The criteria for grading each group on their oral presentation are left to the discretion of the instructor.



## Topic #1: PLL Manufacturers' Websites

	Manufacturer #1	Manufacturer #2	Manufacturer #3
Website			
Part #			
Operational Range			
Tracking Range			
Capture Range			
Latent/Transient Response Time			
Other Specifications			