

Lecture S22 Muddiest Points

General Comments

Today, we talked about the LORAN-C navigation system, and why the pulse shape looks like it does. Part of the reason is that the pulse shape is required to be short (to eliminate skywave contamination), but to have a fairly small bandwidth, so as not to contaminate frequency bands near the 100 kHz band used by LORAN-C. The pulse is designed to have a fairly low duration-bandwidth product.

Responses to Muddiest-Part-of-the-Lecture Cards

(19 cards)

1. *Can LORAN transmitters be used as the land-based part of a DGPS [differential GPS] system? (1 student)* Yes. In Europe, there are LORAN transmitters transmitting DGPS correction information. Do a web search of “Eurofix” to read about this.
2. *Is “gain-bandwidth product” the same as “duration-bandwidth product”? (1)* No, that was a brain-bug on my part. There is such a thing as gain-bandwidth product, which is very important in operational amplifier design, but has nothing to do with today’s lecture. I meant “duration-bandwidth product”.
3. *Would it be possible to program a universal remote with our PRS codes? (1)* Perhaps, but why?
4. *Why is the third upward zero crossing of the Loran-C signal important? (1)* It’s at a point where the signal is large enough to be seen above the noise, but early enough in the signal that skywave contamination is not a problem.
5. *Why are some transmitters “masters” and others “secondary”? (1)* The master determines the group repetition interval (GRI). The secondaries base their transmissions on the master. The master is like the drummer in a band, who sets the rhythm, and the secondaries are like the other players, who follow his lead.
6. *How did they develop the idea of hyperbolic navigation as opposed to triangulation? (1)* “Triangulation” implies being able to measure either distances or angles. This turns out to be hard using radio waves (although VORs, used in aviation, are used to measure angles). It’s fairly easy to measure a time difference, which corresponds to a distance difference, which corresponds to a hyperbola.
7. *What are the advantages and disadvantages if amplitude modulation vs. frequency modulation. I know FM allows greater bandwidth, but is there anything else? (1)* Actually, nothing about AM makes it inherently have less bandwidth. FM is more resistant to interference, and therefore has better sound quality. Since it has better sound quality, FM is used commercially for those radio stations that require higher fidelity. This is why most talk radio is on AM, and most music is on FM.

8. *Is it true that you are considering eliminating the Dragonfly competition? Please don't! (1)* Every year, we review all aspects of Unified, so it's possible that we would eliminate it. However, we have no specific plans to do so.
9. *Are signals sent from the secondaries X and Y the same? If they are, how can you distinguish them from each other? (1)* The Y transmission is delayed, so that any receiver will receive X before Y. So the X pulse always comes after the M pulse, and before the Y pulse.
10. *How do you know how to draw the hyperbola? (1)* If you receive the X pulse 33.33 microseconds after the time of the M pulse plus the delay between the transmission of the M pulse and the X pulse, you know that you are 10 km closer to M than X (since the speed of light is about 3×10^8 m/s). So you are on the hyperbola that has M and X as foci, and has apex 10 km closer to M than X.
11. *No mud. (8)* Good.