26: Digital Control of Stabilized HeNe Lasers?

These types of lasers have been designed using simple analog techniques for over 35 years. So why change? A few op-amps, a monostable or two, and a handful of discrete parts is sufficient for any conceivable level of performance in a mode-stabilized HeNe laser. There are at most two signals that need to be monitored (the polarization modes) with the objective of maintaining them equal or in a fixed ratio. Yet, I've seen at least 3 examples of dual polarization mode stabilized HeNe lasers that have gone from a simple analog approach to a much more complex digital approach, apparently with no obvious technical justification:

- **HP/Agilent 5517:** Xylinx or similar FPGA.
- **Zygo 7702:** Motorola 68HC11 microprocessor.
- **Teletrac/Axsys:** Microchip PIC16C73A-20/SP PIC.

All are basic mode stabilized HeNe lasers. The 5517 is a Zeeman-split laser but the stabilization is mode-based.

The redesign in each case must have cost a fortune. Since none of these lasers had many adjustments in their analog designs, ease of manufacturing is probably not the justification. And there is no need for preventive maintenance as components age – lasers like this will run for years on-end without any adjustments. Cost of components is also not a viable excuse as jelly bean op-amps and other common parts are adequate for any of these lasers. Nor do any require an external computer interface like more complex lasers.

However, one obvious benefit from the company's point of view is serviceability, or lack thereof for anyone not supported by the manufacturer. The new designs are virtually impossible to troubleshoot and repair without detailed service information, and possibly support software. Unless the problem is obvious like a broken wire or blown fuse, attempting to find an electronic fault in these high density surface mount PCBs controlled by firmware programs is just about impossible. And Marketing can promote the "benefits" of digital technology, as bogus as that may be here. If anything, the additional electrical noise from digital signals is a detriment. Digital has to be better, right? :)