Frequency stabilized lasers for gauge block interferometer

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Abstract (300 word limit)

The gauge block is the very important standard to transfer the length unit to industry. The absolute length of the gauge block is determined by interferometry. In general, this interferometer requires multiple frequency stabilized laser sources. The gauge block interferometers of NMIs generally use 633 nm I_2 stabilized He-Ne laser, 780 nm Rb stabilized diode laser and 532 nm I_2 stabilized Nd-YAG laser. Even though the these have the good frequency stability, the system is very complicate and difficult to maintain. The commercial gauge block interferometers use 633 nm two mode stabilized He-Ne laser and 543 nm two mode stabilized He-Ne laser generally. Specially the latter has a bad frequency stability and a problem on its center frequency calibration. [1, 2]

KRISS developed the gauge block interferometer which uses 633 nm Zeeman stabilized He-Ne laser, 795 nm Rb stabilized diode laser and 895 nm Cs stabilized diode laser. Two diode lasers are home-built and their frequencies are stabilized using the digital locking technology with unique filtering technique and a proportional-integral-derivative (PID) servo loop in conjunction with saturation absorption spectroscopy. The digital locking system is based on LabView and field programmable gate array(FPGA) module with real-time CPU controller(RT). The electronic control system is very simple because the filtering and PID servo control is performed by software of FPGA. And also the operator of gauge block interferometer easily find the absorption peaks of Rb and Cs by graphic user interface and the frequency can be locked at the exact absorption peak automatically.

Biography (150 word limit)

Taebong Eom is a Principal Research Scientist in Center for Optics of Korea Research Institute of Standards and Science (KRISS), Republic of Korea. He received PhD in Physics from Chungnam National University, Republic of Korea in 1994. After he joined in KRISS in 1983, he has worked in a precision length metrology field, and his current interests include high precision dimensional measurement using optical interferometer.

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