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## **Refractive index matched half-wave plate with a nematic liquid crystal for three-dimensional laser metrology applications**

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### Abstract:

There exists a need in a quality and accuracy of a three-dimensional laser metrology operating in numerically controlled automatic machines. For this purpose, one sends three laser beams mutually perpendicular. These three beams of the wavelength  $\lambda = 0.6328 \mu\text{m}$  are generated by the same laser and are directed along three independent, orthogonal, mutually perpendicular, optical paths with a given light polarization plain. Using these beams, constituting the frame of coordinates, three independent laser rangefinders are able to determine spatial coordinates of a working tool or a workpiece. To form these optical pulses, a special refractive index matched Half-Wave Plate with nematic Liquid Crystal (LCHWP) was applied. The presented half-wave plate is based on a single Twisted Nematic (TN) cell (with the twist angle  $\Phi = \pi/2$ ) of a rather high cell gap  $d \sim 15 \mu\text{m}$  filled with a newly developed High-Birefringence Nematic Liquid Crystal Mixture (HBLCM) of optical anisotropy as high as  $\Delta n \sim 0.40$  at  $\lambda = 0.6328 \mu\text{m}$ , where the Mauguin limit above  $5.00 \sim \Delta n d \gg \lambda/2 = 0.32$  is fulfilled.