Coherent narrow-band light source for ultraslim endoscopes

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KEY WORDS: Endoscope, RGB laser, monochrome CMOS, Narrow-band image (NBI)

Background: Ultraslim endoscopes with diameter less than 1 mm presenta an interesting frontier, for their applications in cholangiopancreatoscopy and procedures that would require very thin caliber. With the advent of miniature CMOS image sensors of outer diameter as small as 0.8 mm (after packaging) [12] and the emergence of high definition imaging guide (HDIG) [13], the bottleneck in further reducing the total diameter of the endoscope depends critically on the footprint of the matching light source.

The Method: The output of an RGB laser module is coupled efficiently through a few light guiding fiber (~30 μm in diameter) to provides high coherence and high luminosity illumination. The laser is synchronized with a monochrome CMOS camera in a time lapsed manner for color image acquisition and reconstruction. (Fig. 1)

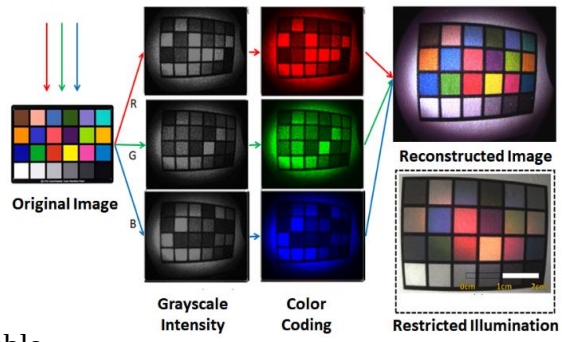

Figure 1: Synthesis of colored images through time lapsed illumination

In this way, high spatial resolution (than a comparable color CMOS camera), higher sensitivity, and narrow spectral band imaging are simultaneously realized, to facilitate differentiation of certain biological tissues or components.

The speckle, as a result of the RGB laser's coherence, which affects the illumination uniformity, is removed through mechanical stress modulation on light guiding fibers at acoustic frequency. (Fig. 2)

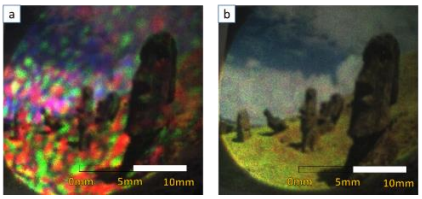

Figure 2: (a) without and (b) with acoustic frequency mechanical stress modulation on light guiding fiber.

REFERENCE

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