Compact Laser Illumination System for Endoscopic Interventions

Seminar lecture presented by Dipl.-Ing. Bastian Blase

External cold light sources as well as LEDs are commonly used for abdominal illumination in minimally invasive surgery. Still, both feature certain disadvantages. A new illumination system for endoscopes based on laser diodes is placed in the handle. No external light cables are needed. High conversion and coupling efficiencies and small package sizes allow for several diodes to be integrated, enabling color mixing and the adjustment of color temperatures. An optical module to collimate and combine the light is described. The heat to be dissipated is stored in a passive latent heat storage based on phase change materials surrounding the optical module. Thereby, operation time is considerably extended, as the handle’s temperature is stabilized. To reduce the negative effect of coherent light on optical rough surfaces leading to patterns of spots, several devices for speckle reduction are developed and tested. By combining these components, an assembly of a powerful RGB laser light module for the integration in standard sized endoscopes is formed.