

absence of noise. For a MMF with larger core radius (but smaller NA such that the total number of modes is preserved), this distance increases.

7. Conclusion

We have quantified the noise amplification for the optimization-based multi-mode fiber endoscopic imaging method originally described in [3], and described three improvements to reduce noise amplification. A comparison of images obtained using noise-reduced OBR and the original OBR yielded a 20% reduction in image error for the noiseless case, and a further 33% reduction in image error at 22 dB SNR for the shot noise-limited case. As a comparison, we simulated imaging an object using both OBR and localized reconstruction under two constraints: on the maximum irradiance or on the total power of the sampling patterns. When imaging using random sampling patterns under the maximum irradiance constraint, we found that the image error using OBR was less than that of localized reconstruction for all SNRs when thermal noise-limited, and down to 18 dB and 19 dB SNR for shot and intensity noise-limited cases, respectively. When using spot sampling patterns under the total power constraint, we found that the image error using OBR was less than that of localized reconstruction for SNRs down to 15 dB, 15 dB and 16 dB for thermal, shot and intensity noise-limited cases, respectively.

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