Response

# Response to "Effect of the fill factor of CCD pixels on digital holograms: comment on the papers 'Frequency analysis of digital holography' and 'Frequency analysis of digital holography with reconstruction by convolution'"

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I welcome the comments[1] on my recent work,[2,3] and I am very pleased to see that the authors of Ref. 1 have taken up the topic and the methods of Refs. 2 and 3. The main difference between Ref. 1 and Refs. 2 and 3 is in the formula describing the digital hologram recorded by the CCD array.

While in my model, Eq. (2) of Ref. 1, the CCD array is the starting point, the authors of Ref. 1 put the holographic field in the focus of their model [Eqs. (4) and (5) of Ref. 1]. Obviously, their approach is the suitable one, because here the holographic field is first low-pass filtered by convolution with the rect function describing the individual pixels of the CCD array, and thus taking into account the fill factor, Eq. (5). Then this filtered hologram is sampled by the comb function and restricted to the array size [Eq. (4)], where the last of these two steps coincides with the approach in Ref. 2. The conclusions drawn in Ref. 1 on the influence of the fill factor onto the PSF of the system are correct. The conclusions are the same as drawn from the numerical experiments by sampling a chirp function presented in Figs. 3 and 4 in Ref. 2. There an emphasis on the modulation transfer function[4] was given.

Concluding this reply, I thank the authors of Ref. 1 for giving a more consistent presentation of the topic, and thus strengthening the basis for further research in the promising field of digital holography.

### References

1. C. S. Guo, L. Zhang, Z. Y. Rong, and H. T. Wang, "Effect of the fill factor of CCD pixels on digital holograms: comment on the papers 'Frequency analysis of digital holography' and 'Frequency analysis of digital holography with reconstruction by convolution,'" *Opt. Eng.* **42**(9), (2003).
2. T. Kreis, "Frequency analysis of digital holography," *Opt. Eng.* **41**(4), 771–778 (2002).
3. T. Kreis, "Frequency analysis of digital holography with reconstruction by convolution," *Opt. Eng.* **41**(8), 1829–1839 (2002).
4. B. G. Boone, *Signal Processing Using Optics*, Oxford University Press, New York (1998).