

4. Conclusions

A new type of aperiodic ZPs based on the Thue-Morse sequence has been presented with interesting focusing and imaging capabilities. We have shown that a TMZP produces two self-similar foci situated symmetrically along the optical axis, one at each side of the focus of the equivalent periodic ZP of the same number of zones. As an image forming device under white light illumination, a TMZP produces a pair of images with an extended depth of field and a strong reduction in the chromatic aberration due to its bifractal focusing behavior. Therefore, TMZPs could be profitable across a broad range of applications where conventional periodic and Fractal zone plates [7] are currently applied including: spectral domain OCT [11], X-ray microscopy [8, 21], design of artificial compound eyes [22], among others [9, 23–25]. Other potential application of these aperiodic lenses will require no absorption losses and improved diffraction efficiency, as for example, bifocal intraocular or contact lens for the correction of presbyopia. To improve the diffraction efficiency of the TMZP here presented the equivalent pure phase diffractive lenses with a blazed profile are currently under study.

Acknowledgments

This work was supported by the Ministerio de Economía y Competitividad (grant FIS2011-23175) and by Generalitat Valenciana (PROMETEOII/2014/072), Spain.