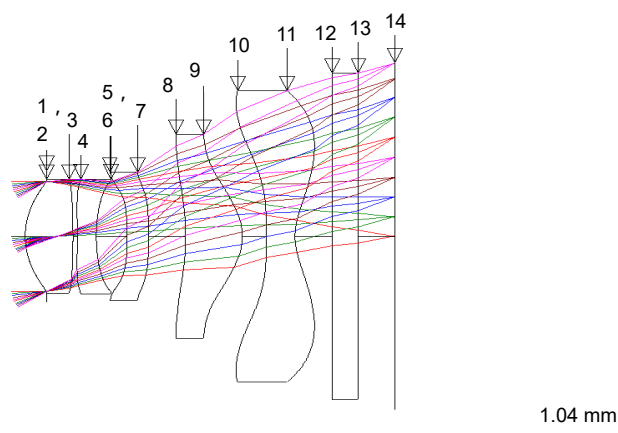


Design of 13 mega-pixel mobile phone lens based on code V

Geng Yuqing¹, Zhao Liefeng², Zhang Xiangdong¹, Ge Peng^{1*}

¹Engineering Research Center for Optoelectronics of Guangdong Province, School of Physics and Optoelectronics, South China University of Technology, Guangzhou, Guangdong 510640, China;

²Guangdong Yejia Opto-electronic Corporation, Dongguan, Guangdong 523000, China



Optimized lens structure

Overview: To meet the unmet commerce needs of high pixel mobile phone, more and more designs come into being. With the maturity of the processing method of the aspheric surface, the improvement of the machining accuracy and applications of the manufacturing materials and CMOS sensor, both benefit the development of the high-quality lens. According to the theory of ray optics, a 13 mega-pixel mobile phone lens was designed based on code V, an optical design software. The sensor OV16880 has 5 mega-pixel which is made by Omnivision Company, whose pixel size is $1.12\ \mu\text{m} \times 1.12\ \mu\text{m}$, so the limiting resolution is 446 lp/mm. In order to shorten the total lens length, effectively control the aberration and obtain better image quality, aspheric surfaces were used on each lens surface. For the sake of safety and cost saving, optical plastics were selected for design. Optical plastic is a kind of ideal material because of its good transmittance, well plasticity and low processing cost. The curvature and even non-spherical coefficients of each lens were set as variables. Code V can change these variables by accelerating the damping two multiplication to improve image quality. We should consider the actual processing, preventing that the concave lens center was too thin, convex lens edge was thin and so on. In the automatic optimization of the structural constraints, boundary conditions were added, so that the lens center thickness was greater than 0.35 mm and the edge thickness was greater than 0.3 mm. The design in this article consisted of five aspherical lenses and a filter. The F-number of the lens is 2.2, the half field angle is 35 degrees, the effective focal length is 3.6, and the total length of the lens is 3.6 mm. The MTF at central field of view is greater than 0.6, at the high frequency is greater than 0.2. In the 0.8 field of view the middle frequency is greater than 0.4. In a word, the lens can meet the requirement of the high imaging quality camera. This mobile phone camera's overall length is shorter than the common design. It can be used to design ultra-thin mobile phone; MTF value is high and well match with the 13 mega-pixel chip. The F number is small under low illumination conditions. Without the help of external light, could also has good imaging quality.

Citation: Geng Y Q, Zhao L F, Zhang X D, *et al.* Design of 13 mega-pixel mobile phone lens based on code V[J]. *Opto-Electronic Engineering*, 2018, 45(2): 170575

Supported by Natural Science Foundation of Guangdong Province (2016A030313473, 2015A030310278), the Key Technologies R&D Program of Guangdong Province (2016B090918057) and the Key Technologies R&D Program of Guangzhou City (201704020038, 201704020182)

* E-mail: scpge@scut.edu.cn