Design technique for compact three-mirror off-axis objectives with Mangin mirrors

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Active development of space remote sensing devices requires compact optical systems with improved image quality characteristics to be created. One of the basic conditions determining modern remote sensing devices appearance is their arrangement on small satellites that sets severe mass and dimensions limitations on design of the objectives. The choices of an optical system layout and its dimensional and aberrational determination are important parts of remote sensing devices designing. Design technique for three-mirror optical systems with Mangin mirrors and off-axis field of view are described in the paper. This technique allows determining constructive parameters (r, d, n), transverse and longitudinal dimensions of optical system basing on the condition of monochromatic and chromatic aberrations correction and required image quality acquisition as well as satisfaction of specified overall dimensions ratios. At the first design stage it is necessary to specify optical powers of components, air gaps or some ratios between them and then to correct chromatic aberration and lateral color. At the second design stage it is necessary to correct four monochromatic aberrations. For chromatic aberrations correction it is proposed to solve a set of equations, where the first chromatic Siedel sum and lateral color sum are equal to some given values. For correction of such monochromatic aberrations as spherical, coma, astigmatism and field curvature, it is proposed to solve a set of equations, where the first four monochromatic Siedel sums are equal to zero or some close to zero values. Consecutive solsions of these sets of equation allow determining parameters P, W u C of each component and then calculating the constructive parameters for further optimization by the optical design software. This technique usage in optical systems design practice allows enlarging the quantity of systems available for analysis, improving the image quality of final layout and forcing of remote sensing devices design.

Keywords: *mirror objectives, mirror-lens objectives, three-mirror objectives, Mangin mirrors, aberrations, overall dimensions ratios.*

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