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A RIGOROUS AND FLEXIBLE CALIBRATION METHOD FOR DIGITAL AIRBORNE CAMERA SYSTEMS

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Abstract. This paper presents a novel family of rigorous and flexible mathematical self-calibration additional parameters (APs) for airborne camera calibration. It is pointed out, that photogrammetric self-calibration can – to a very large extent – be considered as a *function approximation* problem in mathematics. Based on the mathematical approximation theory, we suggest that Fourier series (trigonometric polynomials) be the optimal mathematical basis functions for camera self-calibration. The whole family of so-called *Fourier Self-calibration APs* is developed, whose solid theoretical foundations are Laplace Equation and Fourier Theorem. The Fourier APs are mathematically rigorous, orthogonal, flexible, generic and efficient for calibrating the image distortion of frame-format airborne cameras. We show the theoretical and practical advantages of Fourier APs over the popular polynomial APs and physical APs. The good performance of Fourier APs is illustrated in the many practical tests on camera system calibration, including the DMC, DMCII, UltracamX, UltracamXp, DigiCAM cameras.

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