# The Geometric Analysis of SkySat Satellite Video

*Chia-Hao Lee*[1], *Tee-Ann Teo**[1]

[1] *Department of Civil Engineering, National Yang Ming Chiao Tung University*

Push-frame satellite video is one of the essential developments for microsatellite in dynamic monitoring. The advantages of satellite video include high image overlap and the potential for dynamic monitoring and 3D reconstruction. However, due to the small field of view and high variations in the microsatellite's attitude, direct georeferencing requires geometric correction to enhance positioning accuracy. In this study, video footage captured by SkySat from above Lingya District, Kaohsiung City, Taiwan, was chosen as the research material, for which it provides high resolution. To explore the geometric accuracy of push-frame satellite video, this study performs serial image matching using LSM (Least Squares Matching) to propagate the coordinates of control points to each image frame in the video. The results are then corrected with three different approaches, each utilizing distinct models, which are refined rational function models, attitude compensation rigorous physical models, and orbit position compensation rigorous physical models. Afterward, the results obtained from the three different models were compared and analyzed, while also exploring the relationship between the corrections and satellite attitudes. This comprehensive analysis provides a better overview and understanding of the study's findings. The experimental results unequivocally indicate that all three geometric correction models substantially enhance positioning accuracy, achieving a corrected accuracy of less than 2 pixels. Among these models, the rigorous physical model with attitude compensation exhibits superior accuracy compared to other methods. Furthermore, the analysis of the relationship between the corrections and satellite attitudes reveals a non-linear pattern within the rigorous geometric model. The variation in the corrections can be described by a time-dependent polynomial function, offering the potential to reduce the requirement for ground control point quantity and improve the efficiency of geometric correction computation.

**Keywords:** Satellite video, push-frame, geometric correction, rational function model, rigorous sensor model