

IAF SPACE POWER SYMPOSIUM (C3)  
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THE EFFECT OF SELF-SHADOWING ON CUBESATS POWER GENERATION

**Abstract**

Solar panels are considered a significant part in CubeSats as they are responsible for generating the power from the solar energy. Solar cells have been widely used in space applications due the abundance of the source of the energy being harvested as well as for other reasons. However, CubeSats have strict specifications that limit the surface area available for body mounted solar panels. For that, many CubeSat missions rely on deployable panels in additions to the body-mounted ones. Among other factors, such as the orbital parameters and the CubeSat attitude, the power generated is affected by self-shadowing. This refers to the shadow that the CubeSat deployable solar panels cast on its body-mounted panels. This reduces the amount of output power that can be generated depending on the configuration and the CubeSat orientation with respect to the Sun. Many available CubeSat missions rely on approximating the self-shadowing effect without actually conducting a detailed analysis due the complexity and computational cost for obtaining an accurate estimation. Especially that the configuration of the solar panels, both fixed and deployable, differ from one CubeSat mission to another. The inaccurate power generation estimations could lead to either an underestimation or an over estimation, both of which can affect the mission objectives and requirements. The main objective of this study is to investigate the power generation on CubeSats taking into account the self-shadowing effect. A simplified and computationally efficient approach has been followed and shown to provide useful estimations for the power generation. This was verified by comparing the results with commercially available software for certain deployable solar panels configurations. Furthermore, results show that the power generated is less than that without considering self-shadowing by 5% to 30% depending on the configuration for the cases considered in this study.