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# PRELIMINARY THERMAL AND ORBITAL SPIN ANALYSIS OF NANOSATELLITES

**Abstract**

In space thermal environment, nanosatellites are exposed to many heat sources which continuously increase satellite temperature. Heat is generated by the satellite components as well as absorbed from the environment. Components generating heat are electronic devices, motors and batteries while heat from the environment is due to terrestrial heat sources present in space environment.

The satellite thermal design requires the selection of suitable structural material and devices which can maintain a balance between heat absorbed from and emitted to the environment. Satellite thermal design proceeds by identifying sources of heat and minimizing their effects by releasing and rejecting heat such that all systems components remain within temperature permissible limits. Normally radiators are used to release heat, but due to space and weight constraints with nanosatellites, it is impossible to mount radiators. This problem signifies the importance of thermal analysis of a nanosatellite in space environment.

The paper discusses all the possible heat sources such as solar radiation, Earth's albedo reflected radiation, thermal terrestrial radiation, heat generation in electronic components (Joule effect) and heat capacity of the system. To counter balance the heat sources, satellite cooling sources are also discussed in detail. On the basis of these sources, a thermal balance equation is established. Utilizing the thermal balance equation, temperature of various satellite structures with different colors (absorption coefficients) have been found. Thermal analysis is applied to the CubeSat standard nanosatellite called AraMiS-C1, developed at Politecnico di Torino. AraMiS-C1 satellite surface temperature is found by analyzing different conditions like thermal equilibrium state, transient state and no heat generation by satellite subsystems etc.

The paper also presents a preliminary induced spin analysis of CubeSat standard satellites which is produced due to asymmetrical colors (different absorption coefficient) of the satellite outer surface. The substantial contributors for induced spin have been considered and the estimated spin period has been measured. The absorption coefficient of the AraMiS-C1 satellite which is used in thermal as well as spin analysis have been found through a laboratory experiment.