

49th STUDENT CONFERENCE (E2)  
Educational Pico and Nano Satellites (4)

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DESIGN AND ANALYSIS OF RADIATIVE FIN IN MATLAB FOR SOLAR SAILING  
NANOSATELLITE**Abstract**

Heat transfer takes place through the mode of Conduction, Convection and Radiation. In the Space environment, the Convection heat transfer is negligible due to low atmospheric densities at higher altitude. Hence, Conduction and Radiation are important heat transfer modes in design of Thermal Control System(TCS) for space application. Fins are passive methods to maintain the temperature of electronic devices by dissipating heat from a component by increasing their surface area. The paper presents the design and analysis of radiative fin to be used in COEPSAT-2, a nanosatellite being developed by the students of the College of Engineering Pune(COEP). The problem is formulated based on one-dimensional steady-state heat conduction in fin material having constant conductivity. Mathematical modelling of Radiative fin is formulated using energy balance. This mathematical model is a nonlinear 2nd order Ordinary Differential Equation which is solved using Numerical Methods in MATLAB. Radiative Fin is used in COEPSAT-2 to reduce the temperature of a High Power Amplifier(HPA) IC, a component used in Communication PCB. HPA IC emits around 6.5 W of power during communication with a ground station. The use of radiative fin for TCS resulted in a drop of 13% in the maximum temperature of the HPA IC. This radiative fin is analysed for various parameters such as its length, cross-sectional area, material

and emissivity. Temperature distribution over the fin length is analysed over the above parameters and compared to obtain optimal design parameters and best performance of the fin. Verification of solution is done using Finite Element Analysis on ANSYS Student Version. The paper presents the mathematical model formulation of radiative fin, its solution and application in COEPSAT-2.