Design and fabricate CubeSat Antenna for High-Performance Communication

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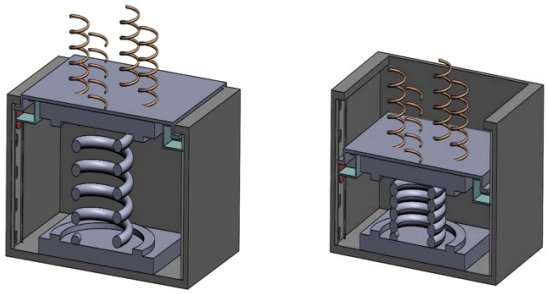
Abstract:

Cube Satellites is an emerging disruptive technology area with a wide scope of applications in the RF and Communications fields. Today, still the range of applications are still under study, it offers tremendous benefits in numerous space purposes. In this paper a novel antenna system with high gain for a CubeSat mission is proposed. We used Computer Simulation Technology (CST) simulation software to simulate our design. Figure. 1 (a and b) show the system before and after deployment.



(a) (b)

Figure 1. A cross-sectional view of the proposed system (a) after and (b) before deployment.

For the antenna system, we used a helical antenna at 8GHz with the circularly polarized characteristic with an axial ratio close to 1. To have a higher gain, a 2x2 phased array has been designed to steer the beam of the antenna system. The scanning range is about ±30º while the axial ratio is <3dB. The gain is 11.6-12.8 dB for the entire range. For feeding network, we used parallel Wilkinson power splitter method. We have fabricated the antenna with tin-coated copper wire to form the helix. Inside the helical antenna, we used Teflon dielectric for resonating and mechanically holding the helices, and aluminum plate as a ground plane. For the body of the CubeSat, since it will be placed in the harsh environment, tin coated copper was picked to be utilized due to its conductivity, strength, and oxidation resistance. For the antenna system aluminum alloy "6061- T6" has been used since it's known for its strength and lightweight properties.

The antenna will be stowed in less than 50 % of the 3U CubeSat size. The system will be placed inside a small cube before deployment. The ground plane is held down by a stainless-steel spring. The spring will be held by a nichrome wire along with nylon fiber which will slow the system until the specific current is provided. As shown in figure 1, on the left and right sides of the cube there is a rail in which the ground plane of the antenna is attached to it so it can stay stable. The antenna characteristics, phase array feeding structures and procedure for design and fabrication and deployment of CubSat will be explained in the presentation.