

Design of Chassis Antenna for Electrically Small Platform  
Using Characteristic Mode Theory

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**1. Introduction**

Electrically small platform has been studied in many literatures and more recently, practical aerodynamic model, especially bug robot model was introduced by Harvard research team [1]. However, the implementation of antenna on the robot for communication has not been demonstrated effectively. It is relatively straight forward idea to attach antenna such as monopole, to robot model directly. However, it makes the bug robot bulky and inefficient. Another approach is to use bug itself as an antenna by using Characteristic Mode Theory (CMT) of the bug robot body. CMT is linear sum of real current modes determined by geometry of model and has property that each mode is orthogonal to the others [2]. To make better use of CMT, designers must consider coupler (booster) structure to excite the desired mode [3]. Recently, intuitive approach with slit structure was proposed [4] on mobile platform. In this paper a novel H-shape structure (see Fig. 1) was proposed to excite the desired mode at 2.4GHz on a bug robot model (69.8mm × 52mm × 11mm)

**2. Coupler design**

By using CMT, can obtain three orthogonal Characteristic Modes on the platform. Based on this, we can determine booster placement location to excite the mode we want to. The H-shape slot structure are located on top and bottom of the wing support structure to enhance the mode excitation targeted. This design consist of FR4 (= 4.5), copper coated and has compact size (10.6mm × 7mm). Applying this, desired mode was successfully excited(purity: 96.12%, FBW=12.26%).

**3. Conclusion**

In this paper, Practical use of Characteristic Mode Analysis for designing of antenna was presented. According to the concept, we can use robot chassis as an antenna with booster which can excite specific mode needed. Consequently the integration in the robot chassis with booster (H-shape coupler) remove the need of external antenna for system. With this structural approach, system can be more durable for operational environment.

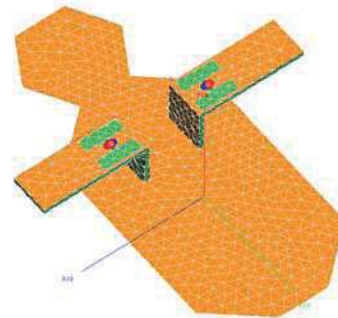


Fig. 1. Proposed coupler structure(H-shape Booster)

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