A PROGRAM CONTROL SYSTEM FOR RV'S ANTENNAS

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Abstract

A attitude destalilization of a reentry vehicle (RV) due to rolling etc. during its flight is one of the major, proflems the channel design of the RV'S radio communication has been facing with. In-this Paper, the requirements of an antenna design are briefly discribed, the need for an antenna program control system is advanced, its block diagram is given, and operating principle and various concept of its components are explained.

Preface

An antenna aboard is one of the key components of a radio system. The antenna design of a reentry vehicle (RV) involes many factors such as the radio system design, overall structure, aerodynamics therml protection, strength, environment, technology and electric performance etc.. the good extent of an antenna performance is not evaluated by one or more indexes, insteed by a combined index.

A RV'S attitude will change because of its angle-of-attack change, ablation and rolling during reentry. A attitude uncertainty will bring some difficulties to the design of the radio system. To meet the attitude variation the radiation pattern of the antenna aboard is usually required to be non-directional and uniform is every direction to assure proper operation of the radio system.

Non-direction requirement for the antenna aboard makes the antenna gain very low. To increase the gain. meet the requirements of the system design and increase the transmitters power or raise the requirements for the ground receiving and transmitting system will result is a difficult design. On the other hand, single antenna can not usually meet the radiation pattern requirement of the non-directionnal antenna aboard because of the limits of the RV'S structure dimensions and layout, but a combination of the antennas can.

However, this antennas combination will increase the number of the antenna windows aboard RV, therefore, increase the difficulties in the overall design, thermal protection, structure and strength etc. and reduce the RV'S reliability and the entire performance, thus, increase the difficulty of a electromagnetic compatibility design.

To resolve the problems described above, author of this paper has suggested seueral design concepts of the antenna program control system aboard a RV to relieve the above difficulties and help the design of the radio system aboard.

Program Control system of RV antenna

A reentry telemetry system can be cited as a sample. Its block diagram is shown in figure 1.

Data gathering and Preliminary Processing:

Carry out a preliminary processing and outting down of the data based on the characteristics of the signal and prior knowledge, input some signals to a modulator and a transmitting system via a time delay memory after a variety of engineering physical quantities (electric and non-electric parameters) have been collected and coded.

A signal from a solar angle meter (its output signal shown in figure 2), or a horizon (its output signal shown in figure 3), or a magnetometer can be used as a bound signal transducer. The RV'S attitude can be rough judged via processing, analysis and calculation of the signal. Switchon the conntrol circuit to make RF switch put through the corresponding antenna to assure the link of the radio system aboard with the ground stations.

The separation signal and attitude data should be inputted to a memory in advance. Then the signal processing shoald be done from the seperation signal, the RV's attitude data and augular speed. Analize the RV'S attitude and position. Yuld a switch command signal to the RF switch to switch on the corresponding antenna.

The plasma sheath formed around a RV during its reentry can cause the antennas to be mistaned, affect and even break the signals. To relieve the problem mentioned above, the following measures should be taken:

Measure the impedance variation in the bruckes of the antenna feed. After amplified and processed, the signal of the impedance variation will be inputted to the telemetry system, at the same time inputted to the controller too. The impedance of the antenna feed system will be improved after it is stored and calculated is the controller. A control signal will been formed and inputted to a impedance tuner. The output wave of the impedance meter is shown in figure 4 and 5.

On the other hand, the ballistic data will be inputted to the controller after they have been preset according to the RV'S actual change during reentry flight. In a actual flight test these data will be readjusted according to the seperation command and the signal of the overload switch. Then a central command will be yulded.

The antennas can be directly linked with the RF switch, thus the antennas distributor can be removed. Sometimes the total number of the antennas can be reduced due to full use of the characteristics of the unit antennas.

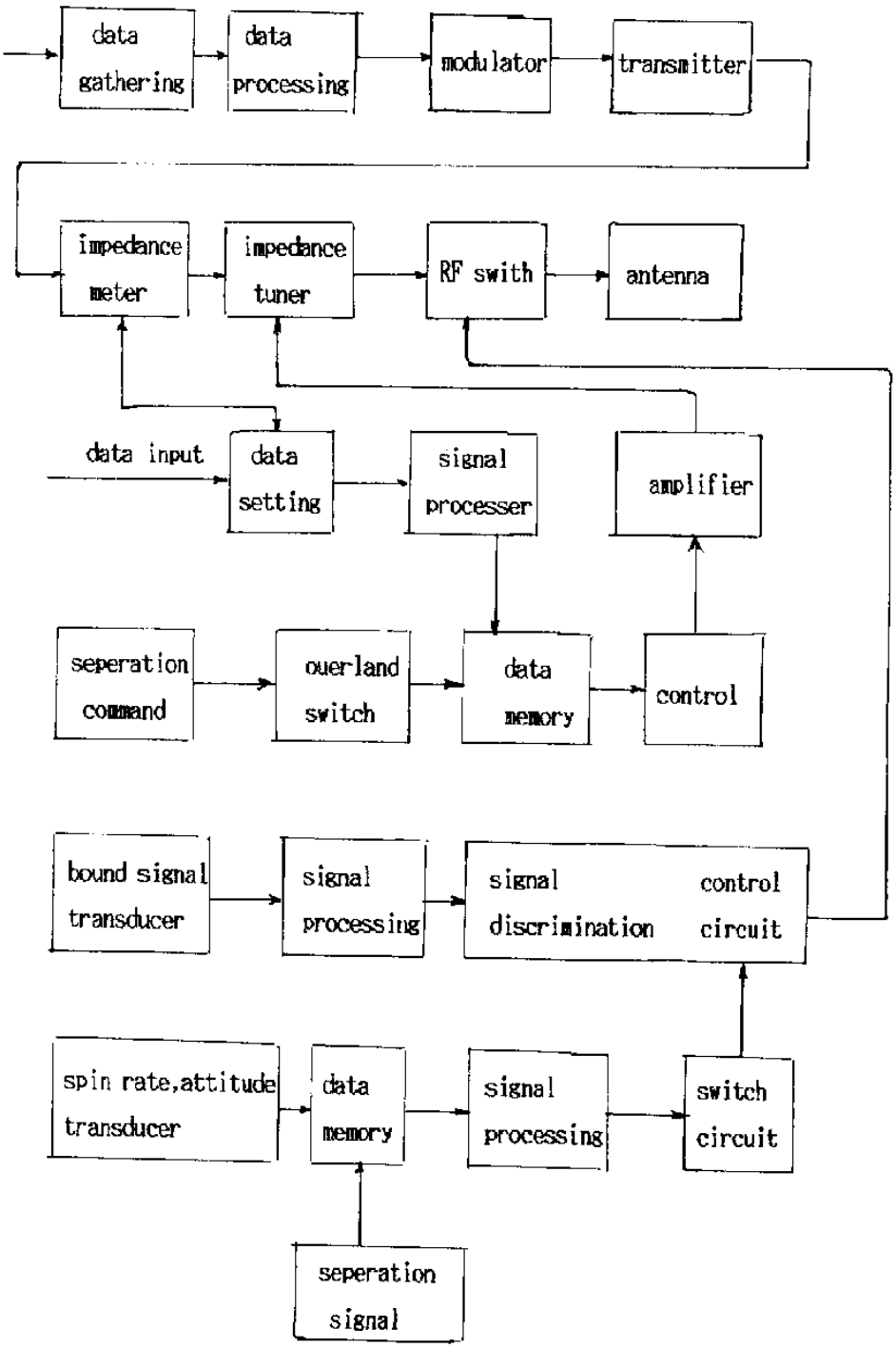
Using the signal characteristics and the properties of the unit an tennas to reduce the number of the antenna windows has been discussed in some special papers.

Conclusions

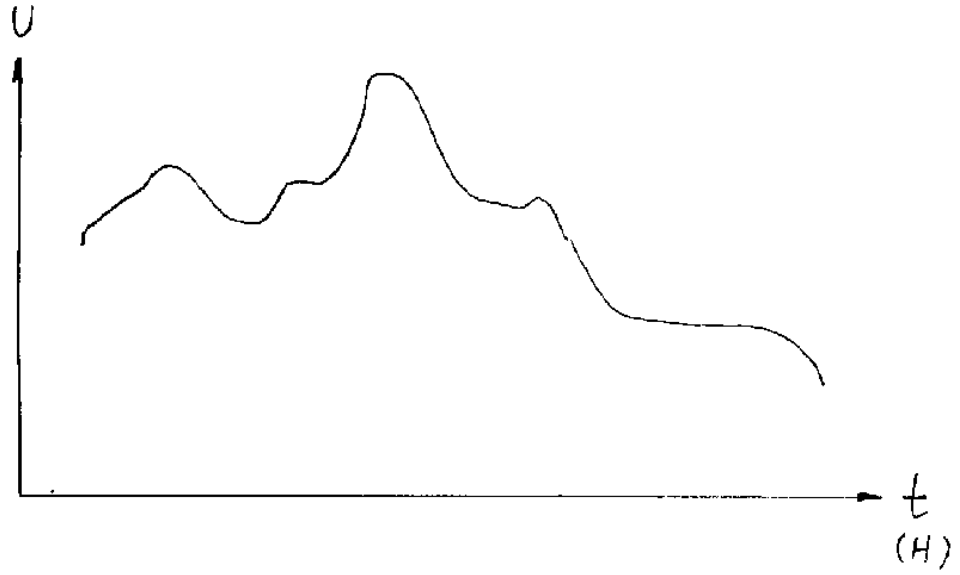
The Program control system of the RV'S antennas makes only some antenna work, can increase the gain of the antennas aboard, improve the environment of the electromagnetic compatibility aboard and protect it from the effect of the RV attitude change. Modulating impendance mismatch of the antennas aboard during reentry will help the improvement of signal transmission through plusma sheath, and protect the transmitter aboard.

Specific practicing concept can be, choosen on the specific design gorl.

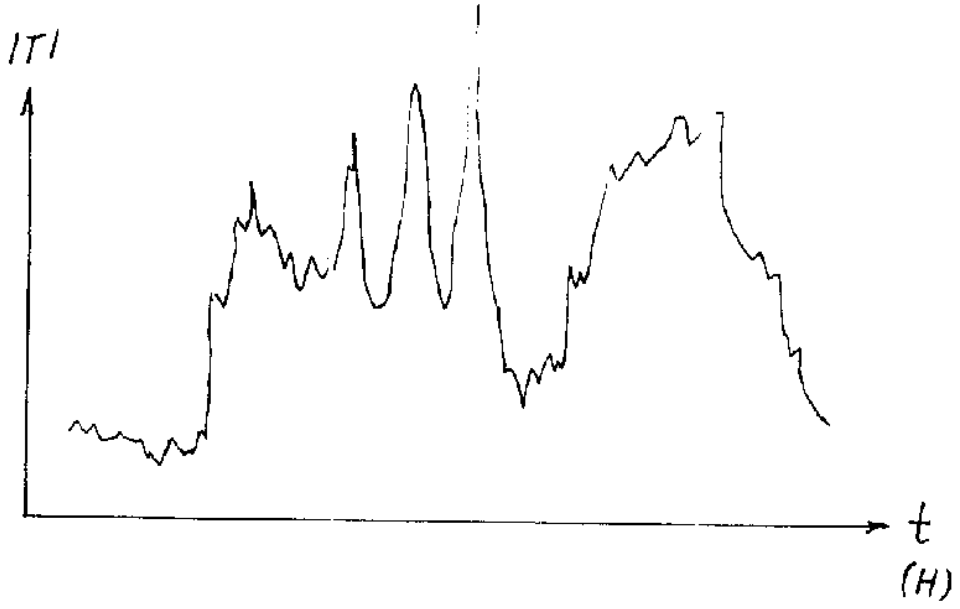
The block diagram shown is picture 1 can be applid to many system such as up-link and downlink etc.



Picture 1. schematic block diagram of recentry telemetry system aboard



Picture 4. Output wave curve of the impedance meter during reentry



Picture 5. Reflectance history of the impedance during Reentry