STATE EVALUATION OF TELEMETRY SYSTEM

MiaoLiuCheng
Beijing Institute Of Tracking & Telecommunication Technology

ABSTRACT

The telemetry system has been used in many important fields. Generally speaking, it's easy to judge whether the system operation is successful or not. But when it is running normally, it is not easy to evaluate the medium state (between success and fail) of the telemetry system, likes a man's spirit state. In this paper, a method with fuzzy theory is brought forward to evaluate the "Spirit State" of the telemetry system. This method can be used to evaluate the telemetry system, or to evaluate other important system states. By this method, the estimation to the mission will be very exact and reliable.

KEY WORDS

State evaluation, Telemetry system, Range test.

INTRODUCTION

Telemetry system is used for acquiring important test data in range test mission, so it is very important to ensure the telemetry system is reliable. As a rule, it will need quite some time to warm-up the telemetry system until it reaches a good state, doing this maybe cost half an hour or more. We have developed test equipment four years ago, with it the transmission precision of FM/FM can be detected. But we have not done much researching work due to lack of financing and time. Today, computer technology is being adopted more and more in telemetry system, it may be easy to evaluate the state of a telemetry system precisely. In this paper, In view of the development direction of telemetry technology, we will study a new method to evaluate the state of a telemetry system.

Presently, the size of telemetry system has been getting smaller and smaller, the degree of automation has been getting higher and higher, the method to evaluate a telemetry system can be closely related to computer. The fuzzy theory and computer technology will be used together with the method to evaluate a telemetry system in this paper.

Method to Evaluate the Telemetry System

The main parameters to evaluate a telemetry system include system transmission precision, input signal dynamic range, receiving channel threshold, multipath rejection, and bit error rate. Because the tuning range and transfer data rate and so on are relatively stable, there is no need to evaluate them.

In order to evaluate a telemetry system, we must establish some standards, which must be alterable with different range test missions, which may have varied requirements. For example, the multipath rejection is an important factor for low altitude flying test; the receiving channel threshold is more important for remote and high-altitude-flying target test. In short, the evaluations result (suppose it is recorded as R) can be described with a state value. The result can be calculated through a state matrix. It can be described as following:

$$R = \begin{bmatrix} s1 \\ s2 \\ . \\ . \\ sn \end{bmatrix} * (v1, v2 ... vn) \qquad (1)$$

Where

R is the evaluation result of certain telemetry at certain time with certain range test mission. When R is bigger than the threshold, the telemetry systems will entry the ready state.

sn is the result of certain state's evaluation, sn can be automatically obtained from system detecting. It is a variable related with time and environment. In this paper, we will discuss how to obtain the variable matrix from the telemetry system.

Vn is the weight-coefficient of certain state's evaluation. It is related with certain range test mission, which can be recorded as a coefficient look-up table.

The Way to Accomplish the Method

There are two difficult points to accomplish the method as shown as formula (1). First of all, we must obtain the sn matrix. In next place, we must define the vn matrix set, we will select one subset according to different range test mission. In this paper, we will build up a relatively simple model to discuss these questions.

It is assumed that telemetry system state includes receiving threshold, bit error rate, multipath rejection and sweep capability, and telemetry system is PCM/FM mode. So n is equal to 4 in formula (1). Next, we will obtain sn from the telemetry system, the method is described as figure 1.

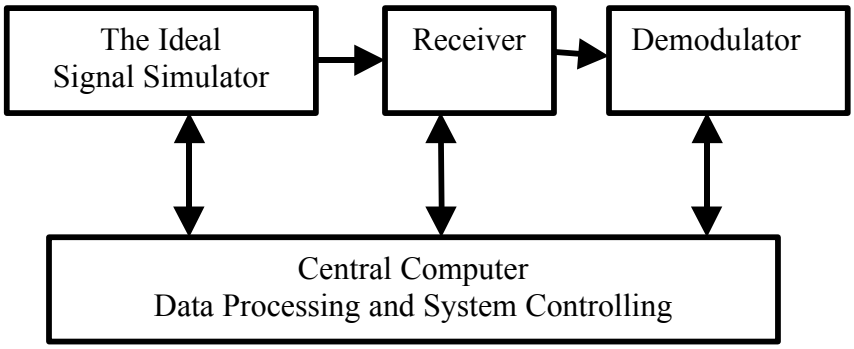

Figure 1 Test-System Configuration

Test-System configuration is shown as figure 1. All of the sub-systems are similar as usual telemetry system, but they can give out test matrix. Here, The Ideal Signal Simulator is controlled by Central computer, and used as calibration facilities. Control of the Ideal Signal Simulator is available from central computer, which is used to control output frequency, output signal level, output noise level, data rate, modulation formats, doppler frequency shift and output multipath signal. In Receiver unit, there are some sensors that can output AGC level, AFC level, PCM threshold and output level, etc. The bandwidth, AGC, AFC, Signal combined or not can be controlled by central computer. In the Demodulator, data rate, mode and loop BW can be controlled via central computer. The parameters of input frequency, input radio level, source data (includes data rate), received data will be real time collected and stored by central computer. At the same time, the computer will calculate the localized coefficient matrix S.

It is assumed that the test mission is about low altitude flying object, so the multipath rejection is important, the weight coefficient about multipath rejection is larger than others. The vn matrix can be described as following.

$$V = (v1, v2, v3, v4) = (0.2, 0.2, 0.5, 0.1) \qquad (2)$$

So R can be calculated.

$$R = S * V = \begin{pmatrix} s1 \\ s2 \\ s3 \\ s4 \end{pmatrix} * (0.2,0.2,0.5,0.1) = 0.2 * s1 + 0.2 * s2 + 0.5 * s3 + 0.1 * s4 \qquad (3)$$

According to the importance or the test mission, when R is more than 0.9, the state of the telemetry is considered to be good.

Conclusions

In Viewed of the direction of telemetry technology development in the world, telemetry system will adopt modularization, standardization, universalizes technologies widely. Telemetry system self-testing should be as easy as that of computer POST. This can be used in other application field, for example telecommunication system or production system or management system. Matrix Dimension maybe more than two, the system and results maybe more complex than the sample in this paper.

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