Forming Zone of Detection of Radio Wave Sensors

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Abstract - **The results of the study design and method of forming the width of the zone of detection of radio wave sensors.**

Keywords - **Radio wave sensor, integrated antenna, zone of detection.**

I. INTRODUCTION

Radar sensors are widely used in various fields of engineering: introscopy, close radar, security systems. They are characterized by high reliability and is sensitive to weather conditions.

Radar sensors operate mainly on two principles: the Doppler effect and registration of the change of the electromagnetic field in the space between the transmitter and receiver when ingested foreign objects there.

II ALGORITHM OF DETECTION ZONE WITH FORMING

In practice, the detection zone width is determined by a range of operating frequencies, the parameters of antenna systems and above the established principle of the sensor. For example, in radio wave sensors, which work on the Doppler effect, detection zone is mainly determined by the shape diagram antenna. In devices based on registration of the change of the electromagnetic field in the space between the transmitter and receiver detection zone width is determined by the size of the Fresnel zones [1]. Therefore, the width of this zone can be several meters.

However, in solving some problems, such as the need of detecting only the fact of moving objects crossing the specified control line it is necessary to have in one of the planes a zone of detection much narrower than in the other [2].

Narrowing the width of the zone of detection in radio wave sensors can be done by narrowing of the width of the radiation pattern, or by switching to higher frequency, which is not always acceptable.

To determine the mechanisms of detection zone formation a mathematical model was developed. It allows the calculation of the form of signals in radio wave sensor at arbitrary movable object considering its transverse dimensions. Experimental verification of the model was done using panoramic standing wave ratio meter R2-61 in 3-centimeter wavelength band by using a physical model of a moving object in the form of metal plates of different sizes, which moved within the radiation of antennas.

Mathematical modeling and experimental studies to determine possible ways of establishing a radio wave detection sensors was performed.

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Narrowing the width of the detection zone in one of the planes was realized by two-beam antenna array and a special two-channel processing scheme of information signal. The criterion for forming a signal of moving objects crossing the control line is equal amplitudes of the Doppler signals received on both channels.

III. RADIO WAVE SENSOR DESCRIPTION

Experimental model of antenna array of the radio wave sensor implemented basing on integrated antennas [3].

Block diagram of the sensor with detection zone formation is presented in Fig. 1.

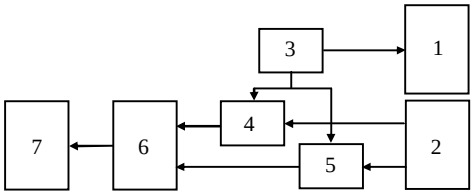

Fig.1. Block diagram of the radio wave sensor

The scheme consists of two integrated antenna arrays – transmitting 1 and receiving 2, which are made on a common printed circuit board, microwave generator 3, blocks processing the Doppler signals 4 and 5, the comparison circuit 6 and alarm signal former 7.

IV. CONCLUSION

The proposed algorithm of detection zone formation allowed its narrowing in the horizontal plane to 0.5 m. It is possible to control only the fact of crossing the control line by the moving objects and further determine the direction of its movement.

REFERENCES

[1] Магауенов Р.Г. Системы охранной сигнализации: основы теории и принципы построения: Учебное пособие. – М.: Горячая линия -Телеком, 2004. –367 с.

[2] Г.М. Виноградов, В.В. Смаглюк, К.В. Колесник Системы охранной сигнгализации на основе электромагнитного потока СВЧ-сигнала и фазообразующих средств / Технология и конструирование в электронной аппаратуре. – 2006.– №1. – С. 13-14.

[3] Прудиус И.Н., Голинский В.Д., Сторож В.Г. Транзисторные антенны-автогенераторы СВЧ-диапазона / Технология и конструирование в электронной аппаратуре. – 2007.– №2(68). – С. 13-16.