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Method for accurate multi-target discrimination and compound friend or foe identification of millimetre wave system based on laser ranging technology

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Lei Zhang

BEIJING SPECIAL VEHICLES RESEARCH INSTITUTE, BEIJING, CHINA.

Introduction

Since the beginning of the 21st century, with the large-scale application of information-based weapons and equipment, combat distance has been continuously increasing and battlefield situation changes constantly, causing mistaken attacks because of error identification from time to time. The most recent typical mistaken attack occurred in 2018. A Russian Il-20 reconnaissance aircraft flying over Syria was shot down by S-200 air defense missiles from Syrian forces. As a result, many Russian soldiers on board died. Therefore, armed equipment can effectively distinguish the attributes of enemy and friend by equipped with an identification friend or foe system, which has very important practical significance for reducing the probability of accidental injury [1]-[6].

Principles

Our method is in combination with the ground maneuvering platform, using the ranging button to start the friend or foe identification. By using a method based on distance comparison, we can address the issue of accurate friend or foe identification with multiple targets. The specific principle is: The ground mobile platform reuses the ranging button of the laser range finder as the button to activate the friend or foe identification. When the ranging button is pressed, the laser range finder emits the ranging laser to the target and receives the reflected signal to calculate the distance to the target. At the same time, the interrogator sends out an interrogation millimeter wave beam covering the target. All targets in the beam will generate a response action. The distance of multiple response targets can be derived according to the response time interval. By comparing the distances generated in ranging process and identification process, we can make a second judgement for the response signal to exclude interference from other targets, and to ascertain the need to query the suspicious target's friend or foe identification attribute.

Results

The ground mobile platform A is equipped with interrogation equipment, and the ground mobile platform B is equipped with answering equipment. The two platforms are successively tested at three distances: near, medium, and far. Among them, the millimeter wave query response identification probability is tested by manual single operation (20 times) and automatic continuous operation (200 times), and the laser query/millimeter wave response identification probability is tested by manual single operation (20 times).

The result of multi-pattern identification probability test is shown in Table 1.

Table 1. Result of multi-pattern identification probability test.

number	mode	distance	correct/total number	Identification probability
1	Millimetre wave query response（automatic continuous）	near	200/200	100%
		medium	200/200	100%
		far	200/200	100%
2	Millimetre wave query response（manual single）	near	20/20	100%
		medium	20/20	100%
		far	18/20	90%
3	laser query/millimetre wave response（manual single）	near	20/20	100%
		medium	20/20	100%
		far	18/20	90%

The ground mobile platform A is equipped with interrogation equipment, and the ground mobile platforms B, C, and D are equipped with answering equipment. The four platforms are distributed in sequence and are on the same straight line. Distances from B, C and D to A are respectively near, medium and far. For B,C and D, A respectively performs manual single millimeter wave inquiry for 20 times. Multi-target response test result is shown in Table 2.

Table 2. Result of multi-target response test.

number	mode	distance	correct/total number	Identification probability
1	Millimetre wave query response（automatic continuous）	near	18/20	90%
		medium	20/20	100%
		far	19/20	95%

Conclusions

By using laser ranging technology, the laser rangefinder and laser alarm device can be properly modified to solve the problem of the misjudgment of the millimeter-wave friend or foe identification system in the case of multi-targets. At the same time, the redundant design of friend or foe identification is achieved, which improves the reliability of identification. It has been verified by experiments that the system has a relatively high identification probability in multiple modes and the ability to accurately discriminate multiple targets.

References

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