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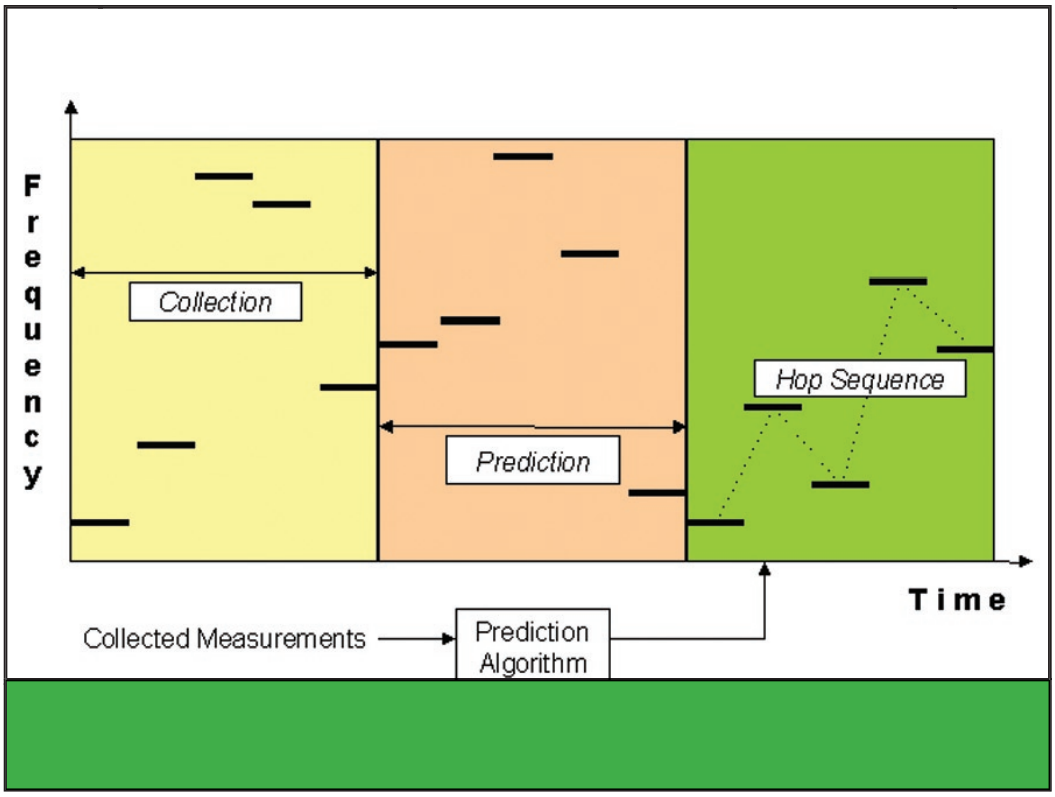
Success Story

SENSORS DIRECTORATE DEVELOPS COUNTERMEASURES AGAINST FREQUENCY AGILE SIGNALS



The Sensors Directorate's successful software implementation of the hop prediction system provides a valuable baseline to the hardware implementation of the frequency agile prediction system. The time-difference-of-arrival technique will provide increased capability, particularly against fast frequency hoppers, at lower cost and complexity of hardware since it monitors only one frequency among the many the system can hop over.

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Accomplishment

In a joint effort with Robert Gold Communication Systems (RGCS), directorate scientists are developing countermeasures against frequency agile signals. Engineers use frequency agile signals to provide resistance to jamming, reduce the likelihood against detection, and offer protection from enemy missiles.

RGCS engineers developed software that uses the time-of-arrival of a few transmissions to determine the hopping pattern of frequency agile signals. As hop rates and standoff distances increase, propagation distances and processing time make it impossible to use "follower" jamming techniques to combat frequency agile signals. Scientists can overcome this deficiency by using times-of-arrival processing techniques.

Background

While two aircraft are communicating over a relatively short range, a standoff sensor or jammer must receive the signal, process the signal, and transmit a jamming signal back to the receiver. The aircraft must complete this process before the receiver changes to another frequency in response to the frequency agility of the target transmitter. As technology continues to develop, frequency synthesizers, used in frequency hopping spread spectrum communication and radar systems, will operate at increasingly higher hop rates, and repeat-back or frequency-follower jammers will become less effective.

Since engineers developed frequency synthesizer implementations that operate at several hundred thousand hops per second and since rates in excess of one million hops per second are entirely feasible, the futility of pursing a follower jammer is clear. Tactical airborne military electronic attack and electronic protection systems have the requirement that any technique developed must operate in real time. This requirement is due to the rapidly changing nature of the battle scenario, the typically short message bursts, and the ability of the uncooperative target link to change the code-of-the-day.

Directorate researchers studied algorithmic techniques to identify information concerning the hard-wired and logical structure of the hopper equipment used by the algorithm to exploit these weaknesses. The time-difference-of-arrival technique requires a collection time where times-of-arrival to single frequency are made. Then the algorithm goes to work, determines the sequence, achieves synchronization, and predicts where and when each successive frequency occurs.

Sensors
Emerging Technologies

Additional information

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