# Design and Simulation of an Infrared Jammer Source for an Infrared Seeker

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**Abstract**
Infrared jammer source is intended for active protection of helicopters against guided missiles with IR homing devices. The majority of such known stations are intended for suppression of IR homing heads with amplitude-phase modulation. Its interfering signal is surfeit 1.5 to 2 times to the signals emitting from the helicopter's engines, and on occasion up to 20 times. The system is capable of suppressing IR homing heads with heightened noise immunity for other types of modulation like frequency-phase.
This paper describes a design and simulation method to assess the effectiveness of IR seeking missile in presence of IR jammer sources on a developed program by paper authors. Proposed method models IR jammer for the missile aerodynamics in six degree of freedom, the missile guidance, and control system. Method validity is verified with experiments on IR seeker reticle. The simulations results show that the proposed design can disturbance tracking and guidance loops adversely. Also, it can increase miss distance.

**Keywords:** IR jammer source, IR seeker

## 1. Introduction

Defeating the guidance system has been the subject of much effort since the 1960s. Flares have proven quite effective against early generation missiles, but the introduction of infrared filters, kinematic filtering in the guidance and two colour seekers in later missiles renders flares nonviable against newer weapons.

Modulated IR sources are employed to countermeasure heat seeking missiles which home in on the heat generating portions of a target such as the engines of an airplane or helicopter. Certain of such systems provide a counter measuring signal to a heat seeking missile through spatial modulation by sweeping a beam in space. Reflective optics is rotated about a source of IR radiation such that the missile receivers a pulse of energy each time the beam passes the seeker. Using of jammers is one of the countermeasure methods with IR homing missiles. Jammer exploits the signal processing of the missile electronics. By adding modulated IR energy to that of the platform, the active jammer adds spurious signals to the missile processing electronics. These signals can cause the seeker to lose the target completely or alter the trajectory of the missile such that it never intercepts the target.
This paper presents design and simulation an IR jammer for IR seeker. After modeling, method validity is verified with experiments on developed program by the papers authors. This paper is organized as follow. Section II develops jammer modeling. Experiments results are reported in section III and finally conclusions are presented in section IV.

## 2. Experiments

The disturbances introduced by the jammer in the seeker tracking loop also may be propagated into the guidance loop and effect the performance of the missile, ultimately resulting in increased miss distance. Because of the complex and nonlinear nature of this problem, digital or physical simulations are necessary to access the impact of postulated jammer approaches and to select the best jammer approaches and to select the best jammer method against a specific missile or class of missiles. In order to, we developed a program for simulations. Figure 1 shows a sample from running of developed jammer simulator program by paper authors.

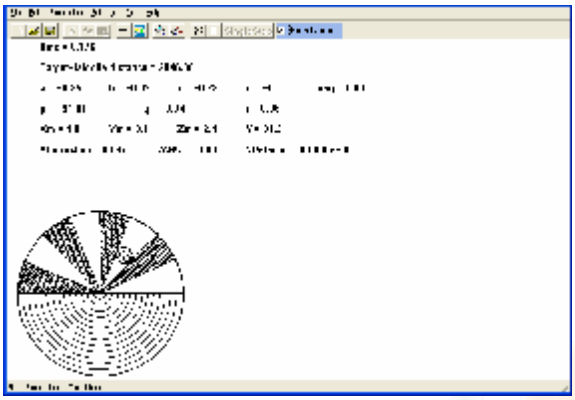

Figure 1: A sample from running of developed jammer simulator program

Table 1 shows different tests results in varies conditions for a special scenario. In this table, frequency, duty cycle, relative intensity, and distance to target are jammer modeling parameters. $f$ and duty cycle present frequency and duty cycle of waveform jammer, respectively. Relative intensity shows jammer intensity respect to target intensity. Distance to target present distance between circles centers of produced by target and jammer.

Table 1: Different tests results for a special scenario

| F [HZ] | Duty Cycle | Relative Intensity | Distance to Target [m] | Miss Distance [m] |
|---|---|---|---|---|
| - | - | - | - | 0.71 |
| 97 | 0.5 | 4 | 5 | 388.97 |
| 98 | 0.5 | 4 | 5 | 500.15 |
| 99 | 0.5 | 4 | 5 | 364.26 |
| 100 | 0.5 | 4 | 5 | 269.40 |
| 101 | 0.5 | 4 | 5 | 397.58 |
| 102 | 0.5 | 4 | 5 | 446.88 |
| 103 | 0.5 | 4 | 5 | 518.66 |
| 100 | 0.2 | 4 | 5 | 204.83 |
| 100 | 0.3 | 4 | 5 | 273.47 |
| 100 | 0.4 | 4 | 5 | 178.79 |
| 100 | 0.5 | 4 | 5 | 269.40 |
| 100 | 0.6 | 4 | 5 | 360.27 |
| 100 | 0.7 | 4 | 5 | 302.45 |
| 100 | 0.8 | 4 | 5 | 150.20 |
| 100 | 0.5 | 2 | 5 | 276.65 |
| 100 | 0.5 | 3 | 5 | 313.29 |
| 100 | 0.5 | 4 | 5 | 269.40 |
| 100 | 0.5 | 5 | 5 | 365.05 |
| 100 | 0.5 | 6 | 5 | 251.93 |
| 100 | 0.5 | 7 | 5 | 192.86 |
| 100 | 0.5 | 8 | 5 | 244.89 |
| 100 | 0.5 | 9 | 5 | 258.64 |
| 100 | 0.5 | 10 | 5 | 283.38 |
| 100 | 0.5 | 4 | 1 | 219.39 |
| 100 | 0.5 | 4 | 2 | 235.63 |
| 100 | 0.5 | 4 | 3 | 273.87 |
| 100 | 0.5 | 4 | 4 | 312.25 |
| 100 | 0.5 | 4 | 5 | 269.40 |
| 100 | 0.5 | 4 | 6 | 403.96 |
| 100 | 0.5 | 4 | 7 | 233.86 |
| 100 | 0.5 | 4 | 8 | 274.78 |
| 100 | 0.5 | 4 | 9 | 263.20 |
| 100 | 0.5 | 4 | 10 | 294.44 |

As shown in Table 1, jammer can increase miss distance.

# 3. Conclusions

This paper present design and simulation of an IR jammer for an IR seeker on a developed program by paper authors. Proposed method models IR jammer for the missile aerodynamics in six degree of freedom, the missile guidance, and control system. Method validity was verified with experiments on IR seeker reticle. The simulations results demonstrated that the proposed design could disturbance tracking and guidance loops adversely. Also, it could increase miss distance.