SIMAT

Dynamic target simulator

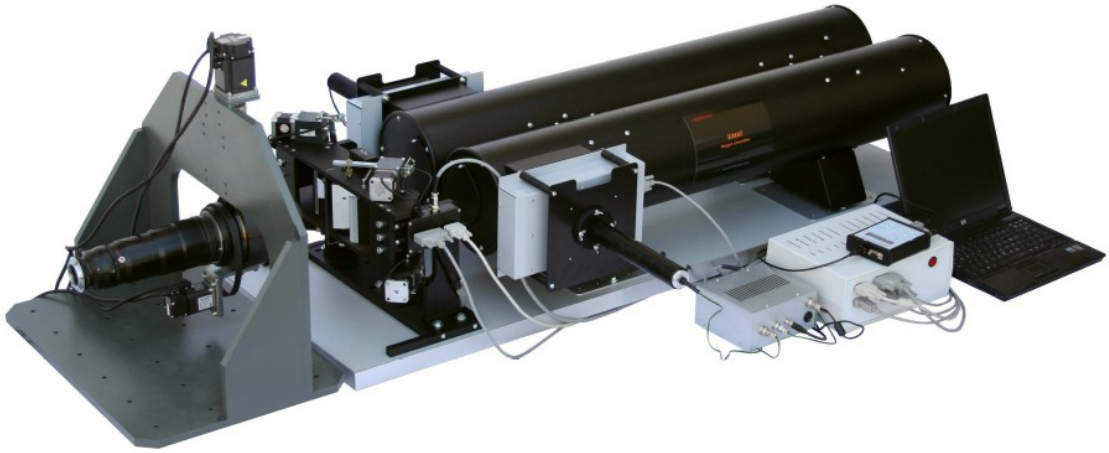

Fig. 1. Photo of SIMAT target simulator

BASIC INFORMATION:

SIMAT simulator is a modular image projector capable to simulate in optical range two variable intensity, variable angular size, variable spectrum, dynamic targets on quasi uniform background. It can be used to simulate dynamic space or airborne/space targets (astronomical objects, aircraft, helicopters, decoys etc.) Simat simulator in its basic version enable simulation in infrared range but can be modernized to enable simulation in both IR and UV/visible ranges. Wide field of view up to 120 deg can be achieved due to use of precision motion table that rotate unit under test.

The system is computerized and sophisticated scenarios (target trajectories, angular sizes, speed, radiation intensity) can be simulated.

PRINCIPLE OF WORK

The principle of work of SIMAT simulator is based on the concept of combining two different image projectors used to simulate small size high temperature targets and to use a large semi-transparent IR source to simulate variable temperature background. Images generated by the two target projectors (primary target and secondary target (or targets)) are superimposed on blurred image of the semi-transparent source simulating background by use of beam combiner located at the input of the tested system. The beam combiner is also used to vary relative angular position of both targets and to simulate dynamic move of a target along a planned trajectory within tested sensor field of view.

Two off axis reflective collimators with IR sources located at their focal planes are used as target projectors. Simulation of changing distance tested sensor-target is done by continuous change of angular size of both primary and secondary target. Regulation of infrared radiation emitted by the targets is done by control of temperature of the IR sources or by use of spectrally neutral attenuators. Distance simulation to targets is achieved by step/continuous regulation of angular size of the targets. The targets can move with high precision on programmed trajectories within relatively narrow field of view (below 8º) to simulate real life scenarios. However when the tested sensor fix to the motion table and rotated then much wider field of simulation can be achieved (up to 120º).

APPLICATIONS

- Scientific projects where simulation of dynamic targets of high intensity variable optical spectrum is needed
- Testing automatic target recognition systems for surveillance of astronomical objects
- Testing sensitivity and intelligence of imaging or non-imaging seekers
- Testing algorithms of for target recognition of modern semi-automatic surveillance systems

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BASIC FEATURES

Function	Description
Simulated scenery	two small size, variable intensity, variable size, dynamic targets on quasi uniform variable temperature background. PC controlled trajectory.
Field of view	Image of scenery of 7° circular 5°x5° angular size is projected. By rotation of the tested sensor fixed on the MD2D motion table the simulated field of view can be increased up to 120 deg (circular).
Spectral range	1-5.5 μm (can be extended to cover UV, Visible, IR)
Background simulation	Variable temperature semi-transparent blackbody.
Method of creating image of two independent targets	Combining of images of two targets generated by two off axis reflective collimators using reflective beam combiner
Distance simulation method	Continuous regulation of angular size of the targets using electronically controlled apertures. Simplified versions: step regulation.
Angular movement simulation method	regulation of angular position of mirrors in beam combiner
Regulation of radiation emitted by targets	Temperature regulation of blackbodies/IR sources and by use of neutral attenuators
PC control	Distance to the targets (angular size of the targets), target angular position, targets radiation (temperature regulation)

SPECIFICATIONS

Parameter	Value
Unit under test	
Spectral range	1-5.5μm range (option: any band in range from 0.3 to 15μm)
Max sensor aperture	circular not bigger than 80 mm
Field of View	<7° (circular) or <5°x5°(square)
Resolution	not better than 0.2 mrad
Primary target simulator	
Number	one
Target shape	rhombus (option: triangle)
Target size	Continuously regulated size 0.2 – 10 mrad (option: up to 40 mrad)
Speed of target size regulation	up to 10 mrad/sec
Radiation source	a set of two exchangeable IR sources: HTCB-1000 blackbody and IR 2300 electrical infrared bulb
Attenuator	set of five manually exchanged filters
Attenuation range	1:1000 (five steps)
Angular position	a)regulation of mirror position in MBC beam combiner – regulation in narrow field of view below 7° b)regulation of angular position of sensor fixed to MT2D motion table – regulation in wide field of view below 120°
Speed of regulation of angular position	a)up to 10°/sec using MBC beam combiner b)up to 100°/sec using the MT2D motion table
Secondary target simulator	
Number	One
Target shape	rhombus
Target size	continuously regulated size 0.2 – 10 mrad (smaller non regulated sizes when more targets are to be simulated)
Speed of target size regulation	up to 10 mrad/sec
Radiation source	a set of three exchangeable IR sources: HTCB-1200 blackbody, two electrical infrared bulbs: IR2300, IR 3000. Radiation from these sources can be modulated using OM-2 chopper. Optionally a set of IR laser diodes/IR LEDs can be added.
Attenuator	set of manually exchanged five filters
Attenuation range	At least 1:1000 (five steps) – spectral band: 1.1-5.5 μm
Angular position	a)regulation of mirror position in MBC beam combiner – regulation in narrow

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	field of view below 7° b)regulation of angular position of sensor fixed to MT2D motion table – regulation in wide field of view below 120°
Speed of regulation of angular position	a)up to 10°/sec using MBC beam combiner b)up to 100°/sec using the MT2D motion table
Background	
Radiation source	STB infrared source
Type	Semi transparent grey body
Radiation area	100x100mm
Effective temperature regulation range	At least from ambient to 100°C

VERSIONS:
SIMAT simulator can be delivered in two versions of different test capabilities and different price level.

Version code	Components	Capabilities
SIMAT-A	CDT1000 collimator, HTCB-25D-1000 blackbody, AT attenuator, IR2300 source, motorized variable aperture MAR 1 PC, SIM Control-A software, set of power suppliers	Simulation of a single static variable size, variable intensity, variable spectrum infrared target
SIMAT-B	CDT1000 collimator x2, HTCB-25D-1000 blackbody, AT attenuatorx2, IR2300 source, IR 3000 source, motorized variable aperture MAR 1, motorized variable aperture MAR 2, MBC beam combiner, PC, SIM Control-B software, Set of power suppliers	Basic simulation of two variable angular position, variable size, variable intensity, variable spectrum infrared targets for narrow field of view (about 7°) - no modulated secondary source - no variable temperature background - secondary target simulated only by IR 3000 source (no HTCB-1200 blackbody)
Simat - C	CDT1000 collimator x2, HTCB-25D-1000 blackbody, HTCB-25D-1200 blackbody, STB infrared source, AT attenuatorx2, IR2300 sourcex2, IR 3000 source, OM-2 chopper, motorized variable aperture MAR 1, motorized variable aperture MAR 2, MBC beam combiner, PC, SIM Control-C software, Set of power suppliers	Extended simulation of two variable angular position, variable size, variable intensity, variable spectrum infrared targets for narrow field of view (about 7°) on variable temperature background
SIMAT-D	components from version C and MT2D motion table	Simulation of two variable angular position, variable size, variable intensity, variable spectrum infrared targets on variable temperature background for wide field of view (up to 120°)

The presented above typical versions of Simat are optimised to enable simulation of IR targets at spectral range from 1 to 6µm. Simat can be updated to enable simulation: a)1 to 14µm spectral range, b) 0.3- 15µm spectral range.

Version 4.2

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