



OO/UC3M/38- FREE-SPACE LASER OPTICAL LINK SIMULATION SOFTWARE LÁSER

GDAF (*Displays and Photonics Applications Group*) in *Electronics Technology Department at University Carlos III de Madrid* develops a hardware-software application for a communications free-space optical link, in a Project with *INSA corp.*

It aims to substitute the usual radio frequencies link, because of the increasing of bandwidth and the guarantee of privacy. Optics and electronics collaboration is searched.

Description and special features

The link is established between an Optical Ground Station (OGS) using a laser, and a satellite equipped with a retromodulator. It pretends the substitution of traditional radio links, because of both its bandwidth increment and the privacy absolute guarantee.

GDAF has developed:

- A simulation software that computes the power balance of the link, according the atmospheric channel conditions, output in the OGS and reception.

The interactive computation of atmospheric losses and fading has been developed in a software Matlab-based application called ALCOLINK v1.1 (*Atmospheric Losses Computation in an Optical Link*). A wide range of scenarios are able to be simulated in this software, choosing in each case different analysis criteria, such as a link length, aerosol type, selected wavelength, cloud kind in the atmosphere, zenith angle, transmissor lens radius... The software computes the losses involved mainly in the atmospheric channel.

- A pointing and tracking hardware and software of the budget.

Pointing and tracking is divided in three main blocks:

- Software.
- Hardware: control electronics.
- Mechanical system.

It uses a PC running routines programmed in LabView, and it also implements an electromechanical system that executes the physical movements, according the orders from the program. A laboratory demonstrator has been developed, using a double system:

- A motorized altazimuth mount that carries the mirror that redirects the laser beam towards the beacon.
- A motorized altazimuth mount that carries the webcam that allows the tracking by means of image acquisition.

Camera images are processed by the PC by algorithms absolutely made by GDAF in LabView 8.5. This processing governs the camera and mirror movements, from the PC and through an electronic system fully designed and developed by GDAF, using a microcontroller and different custom made drivers for the movement signals generation.

Companies interested in developing optical components of the OGS are searched.

This Project is a part of FACTOTEM, a Project with eight partners at the Comunidad de Madrid, Spain, S-0505/ESP-417. It is coordinated by Prof. José Manuel Otón Sánchez, from the Universidad Politécnica de Madrid.

Innovative aspects

No commercial programs exist having such a parameter variability in an free-space optical link. The software allows their modification to check their effect in the link. It is also possible to introduce real data of OGS and spacecrafts links or components, to check their possibilities of use in a real space link.

The optical components of flight and area systems can be tested before their insertion in a link, simulating



Innovative aspects

their behaviour by means of the program.

The balance of link this software allows to obtain provides a way of checking the kindness of a communications free-space link. The possibilities of this involve the construction of flight systems based in satellites of terrestrial or planetary orbits.

Competitive advantages

The interest for any company taking part of a optical communications satellite link is the fact that it will be a part of leading technology in aero spatial communications, a technology that gives the possibility of having full privacy and increased bandwidth. The introduction of the parameters involved in the company optical or electronic components acts as an added value for their characterization and applications.

Technology Keywords

Software; Wide band technologies; Satellite technologies/ systems; Satellite navigation systems; Spatial technology and exploration;

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