Republic of Iraq-Baghdad
Ministry of Higher Education
and Scientific Research
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Design and Simulation Secure Optical Communication System in Turbulent Weather Based on Chaotic Laser System

A Thesis

Submitted to the Department of

Laser and Optoelectronics Engineering/University of Technology as a

Partial Fulfillment of the Requirements for the Degree of Master Science

in Laser Engineering

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(B.Sc. 2017)

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2022 **1444**

ABSTRACT

The free space optical (FSO) communication system has many benefits, However, the security in FSO communication systems is considered one of the main problems. This work includes three main parts: 1) design and implementation of a secure FO system and secure FSO system based on optical chaos, the results show that adding optical chaos caused degradation in both systems. In FO system, fiber length degradation is about 69%, while in the FSO system, the link range degradation is 53% in good weather and 46% in bad weather. 2) to design a secure hybrid FSO-FO system based on optical chaos. According to the results, the link length after adding chaos laser is degraded for all weather conditions. This degradation can be minimized by using dispersion compression fiber (DCF) and dual–FSO (D–FSO) channels, where system length is enhanced by 38.8% at light fog and 40.9 % at haze. 3) Increasing the bitrate product repeater distance (B×L), which represents the figure of merit in communication via wave division multiplexing (WDM). Based on the results of the secure WDM–FSO system, the optical chaos that degrades the link distance significantly more in good weather than in bad (the link is degraded from 4.4 km –to– 2.3 km and from 1.5 km –to– 0.8 km in light fog and haze, respectively). In addition, the proposed system has a B×L of 92 Gb/ s.km and 32 Gb/ s.km in light fog and haze, respectively. Furthermore, the performance of the proposed system is investigated and compared with the previous work under the same weather conditions (light fog, light rain, moderate fog, heavy rain, and haze). The bit rate in our work is about 75% higher than the earlier work, resulting in a higher BL in all weather conditions.