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ANALYSIS OF VIBRATION CHARACTERISTICS IN LASER COMMUNICATION USING ARM

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ABSTRACT

In this paper, analysis of the vibration characteristic of the laser communication platform is performed. On the laser communication platform, vibration effect influences on the overall accuracy and stability largely. In our platform a new vibration simulation system based on ARM is brought. In this system, the random numbers which are generated by ARM are output as a PWM (pulse width modulation) mode to drive the motor. The laser beam is then analysed on the Vibration Spectrum Simulation- MATLAB. The result is then compared with the theoretical values to get the correct analysis of vibration characteristics of laser. The motor is driven by ARM environment to achieve the vibration simulation of the laser communication. The analysis is based on the vibration simulation, including the data processing and the final results.

KEYWORDS: laser communication, vibration spectrum, PWM motor driver.

INTRODUCTION

Laser Communication is one of the emerging areas of wireless communication system. Due to its low noise ratio makes its one of the well suited communication medium for exchange of information. Currently laser commutation is adopted in satellite communication for space research activities and due to its efficiency on low noise ratio, inexpensive, low power and its flexibility and its resistance to the radio interferences makes laser communication as one of research area in wireless communication.

Laser communications systems are wireless connection through the atmosphere. Which is focused on decreasing the noise ratio in optical communication system? Laser communications systems work similarly to fiber optic links, except the beam is transmitted through free space. In Laser Communication the transmitter and receiver must require a line-of-sight conditions and Laser communications systems have the benefit of eliminating the need for broadcast rights and buried cables. Laser communications systems can be easily deployed since they are inexpensive, small, low power and do not require any radio interference studies. The carrier used for the transmission signal is typically generated by a laser diode. Two parallel beams are needed, one for transmission and one for reception. Laser communications plays a key role, as solutions for satisfy ever increasing high demand of bandwidth. In Laser communications systems bandwidth could be distributed in neighbourhoods by putting systems on top of homes and pointing them towards a common transceiver with a fast link to the Internet. It supports possible transmit speeds of up to a gigabit per second, Other applications of Laser communications systems technology include temporary connectivity needs (e.g. sporting events, disaster scenes, or conventions), or space based communications.

High tracking accuracy is needed and precision of value is usually in micro radian middleweight when the space of the whole system in laser communications is working. Communication servo platform usually brings low frequency disturbance and high frequency vibration, and they are both vital interference sources. Communication quality is so sensitive to these disturbances. The analysis is based on the vibration simulation, including the data processing and the final results.

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PROPOSED WORK

Block Diagram

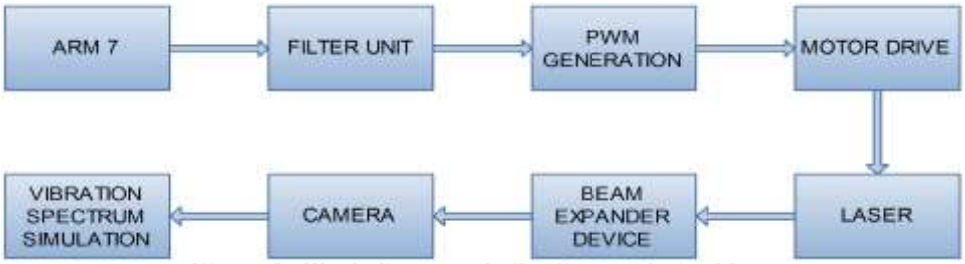

Figure 1: Block diagram of vibration analysis of laser

Description

Figure 1 shows the block diagram description of vibration characteristics analysis of laser communication platform using ARM .It consists of ARM, a filter unit, PWM generation, motor drive, a laser source, beam expander device, a camera and vibration spectrum simulation program

An arm is used to control the vibration movement of the laser. An arm produces the PWM waves which are given to a motor which controls the vibration of the laser. The output of the laser is then given to the beam expander unit. Laser beam expander unit is a reverse telescope system whose magnification time is 20, and it can magnify the diffusion angel of beam to 50 μrad. This beam is then given to the camera which captures the images of the laser beam n sends it to the vibration spectrum simulation. It simulates the data and gives the required data

METHODOLOGY

The laser beam used in the laser communication platform is analyzed using MATLAB. The maximum deviation is measured for the beam. And its characteristics are calculated. The vibration of laser source is controlled using PWM characteristics.

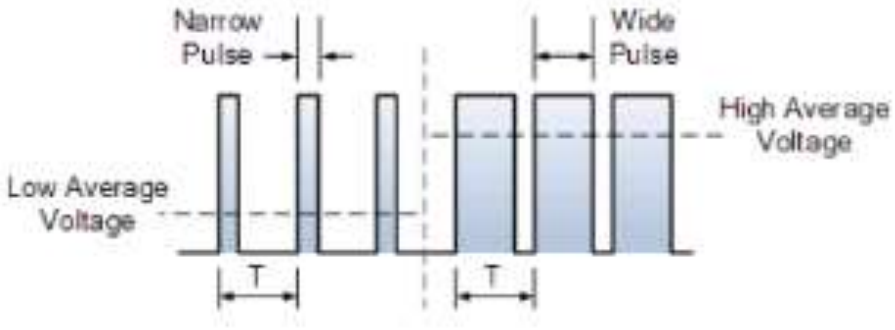

Figure 2: *PWM waveform*

The use of pulse width modulated waveform to control a small motor has the advantage in that the power loss in the switching transistor is small because the transistor is either fully "ON" or fully "OFF". As a result the switching transistor has a much reduced power dissipation giving it a linear type of control which results in better speed stability.

Also the amplitude of the motor voltage remains constant so the motor is always at full strength. The result is that the motor can be rotated much more slowly without it stalling.

As its name suggests, pulse width modulation shown in figure 2, speed control works by driving the motor with a

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series of "ON-OFF" pulses and varying the duty cycle, the fraction of time that the output voltage is "ON" compared to when it is "OFF" of the pulses while keeping the frequency constant.
The power applied to the motor can be controlled by varying the width of these applied pulses and thereby varying the average DC voltage applied to the motors terminals. By changing or modulating the timing of these pulses the speed of the motor can be controlled, ie, the longer the pulse is "ON", the faster the motor will rotate and likewise, the shorter the pulse is "ON" the slower the motor will rotate.
In other words, the wider the pulse width, the more average voltage applied to the motor terminals, the stronger the magnetic flux inside the armature windings and the faster the motor will rotate.

RESULTS

The proposed architecture is simulated in MATLAB . The simulation result is as shown in figure.3

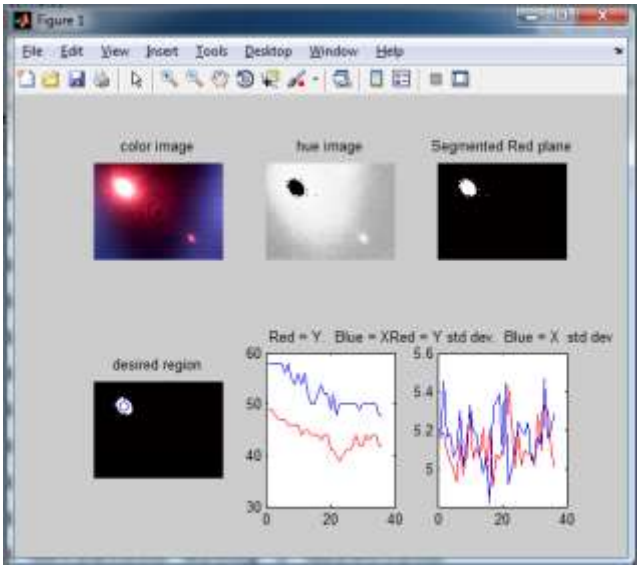

Figure 3: Simulation Results

The table 1 shows the various readings of laser beam taken for different vibrations

Table 1: *Result for deviation of laser beam*

x min	x max	y min	y max	std x	std y	flag
5	5	44	44	0	0	0
67	68	31	34	0.57735	1.290994	2
46	120	53	160	17.93028	26.8652	2
37	37	27	28	0	0.707107	2
22	22	37	38	0	0.707107	2
26	26	33	34	0	0.707107	2
9	10	19	20	0.57735	0.57735	0
42	42	23	28	0	1.870829	2
1	1	41	42	0	0.707107	2
54	105	1	160	9.262143	41.76473	2
6	9	27	34	1.080123	2.170509	2
109	120	45	88	2.851923	12.2286	2
4	6	41	44	0.894427	1.169045	2
70	71	33	34	0.57735	0.57735	0

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CONCLUSION

The vibration signal we have simulated is approximate to the real vibration on the laser communication platform. It can be used as reliable vibration source in experimental communication simulation platform. It means a lot in analyzing the influence of the vibrations on communication quality. Vibration of the transmitted beam in the receiver plane decreases the average received signal, which increases the bit error rate.

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