HIGH RESOLUTION STEPPER MOTOR CONTROLLER FOR TUNABLE LASER

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Degree of Master of Science

Department of Electronic and Telecommunication Engineering

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DECLARATION

"I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Masters under my supervision.

Signature of the supervisor: Date:
(Prof. Rohan Munasinghe)

Abstract

Tunable laser systems use stepper motors to rotate the wave selective optical elements. Stepper motors can rotate with high accuracy and precision. This research focuses on the stepper motor controller, with the feedback to improve the accuracy and the precision of the movement. Sine cosine and trapezoidal current controlling techniques for microstepping are analyzed, and used in two different types of situations. The variable step interval technique is proposed to overcome the speed variation in the trapezoidal current controlling technique. The proposed controller uses the linear interpolation and sine cosine current controlling technique to improve the rotation accuracy by two times than the resolution of the encoder. The technique is proposed to detect the obstacle by using the encoder and the static characteristic of the stepper motor. The simulation and the experimental results show that proposed controller can produce the required accuracy, the precision and obstacle detection. Also, the movement smoothness could be achieved by variable step intervals. Therefore, proposed controller has better performance to suit the tunable laser system.

Keywords: Stepper motor, tunable laser system, wave selective optical element, precision, accuracy.

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LIST OF ABBREVIATION

Abbreviation	Description
QEI	Quadrature Encoder Interface
RPM	Revolution per Minute
s	Second
S	Laplace notation
Hz	Hertz
PM	Permanent magnet
MIPs	Million instruction per second
Rev	Revolution
UART	Universal Asynchronous Receiver Transmitter
PWM	Pulse width modulation
PLL	Phase Lock Loop

pk-pk	Peck to peck
DC	Direct current
ESR	Equivalent series resistance

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