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Analysis of Potential Designs for Multi-Channel Optical Slip Rings in Terms of Optical Transmission Characteristics Dominating Data Rates, False Rates, Power Handling.

ABSTRACT - Masterthesis

The master thesis work involves potential analysis of multi-channel optical slip ring unit.

The motivation behind doing this project is to give a basic idea of development of conceptual design and experimental investigation of potential study of optical slip ring unit. Analysis of optical characteristics in terms of optical power handling, data rates and false rate indicates performance of optical slip ring unit. It points to requirement analysis for mechanical design and development.

Initial survey of available designs in industries, literature review and patent study provides requirement analysis, theoretical design specifications and basic interpretation for design of optical slip ring unit. Requirement analysis represents specifications and characteristics of optical components. Theoretical analysis of optical slip ring unit interprets the layout for optical slip ring unit.

Practical verification of theoretical design includes execution, observations, result analysis and conclusion of various experiments. First experiment of alignment of a pair of GRIN collimators describes performance of optical slip ring component. An automated data transfer system is created to check loss of data by using initial experimental set up of optical slip ring component. Qualitative analysis of GRIN collimator is implemented to test performance of GRIN collimator fibers.

New approach of design is carried out for collimator system after finding out incompatibility of GRIN collimator for optical slip ring design. Alignment of single mode ferrule fiber and Plano-convex lens system is realized in next experiment.

Measurement of optical characteristics of optical slip ring unit is divided into measurement of optical power, insertion loss measurements, determination of no signal position for rotation analysis of optical slip ring component, reflection loss measurement, false rate in terms of Bit error ratio (BER) and Q-factor measurements and estimation of optimum position for bidirectional transmission.

The results of this project presents mechanical design requirements, optical performance and specification of optical slip ring component. From the observations of optical power measurements, a pair of single mode ferrule with Plano-convex lens system is aligned. Insertion loss of aligned pair is within the requirements of optical slip ring unit. False rate in terms of BER and Q-factor measurements indicates noise induction in data transfer system due to optical lens system.

Observations and measurements from experimental work are extensively used to define initial concept of optical slip ring unit.