Final Report Summary

Lifetime Testing of Optoelectronic Components

Helia Photonics Ltd
http://www.helia-photonics.com/

Heriot Watt University (OIC Group)
http://www.optical-computing.co.uk

Abstract:
The project undertaken by the two partners formed a good matching of resources, skills and output. The project focussed around the design and construction of a station for accelerated lifetime testing of optoelectronic components, and in particular, laser diodes. The test system had relatively strict specifications and required considerable mechanical, electrical and optical design input from the partners. The result has been beneficial for both partners.

Introduction

The temperature test facility is designed to supply a lifetime testing industry requirement as specified by Helia Photonics.
The primary research interest from the Optoelectronic Computing (OIC) group at Heriot-Watt was in the use of the system for testing more sophisticated devices and specifically device/lens combinations.
The mechanical workshops within the School of Engineering and Physical Sciences at Heriot-Watt University designed and machined the opto-mechanical components for the test facility which were then assembled and tested at Helia photonics. OIC also delivered a software suite for the control of the devices and the associated measurement electronics. This was of a type similar to the control systems within OIC and was initially run within their laboratory. Subsequently the control suite was transferred to Helia to run on existing equipment. A potential future development phase of the project will be to adapt the software to run on a much more versatile platform, that of FPGAs. This move meshes well with the partners' future ambitions.
The report is divided into three sections firstly mechanical design and construction and secondly the electronic design and software. A third section provides a brief description of the devices to be tested.

Mechanical Design and Construction

The mechanical design incorporated electrical and optical connections within a small temperature controlled vessel. The construction was made of copper and was compatible with a wide range of optical packages, and suitable for the development stages of various optoelectronic components.
The oven drawer dimensions are approximately 80x80x200 mm.

Electrical Design and Software

Example screens for the user operator are shown first followed by the flow chart and control parts of the system. A typical operation sequence is described in the flowchart in figure 1. An example of the GUI screen (at constant current operation) is shown in figure 2. The code was completely built in visual basic. The code allows for several modes of operation, and is easily customisable to other and more complex sequences.

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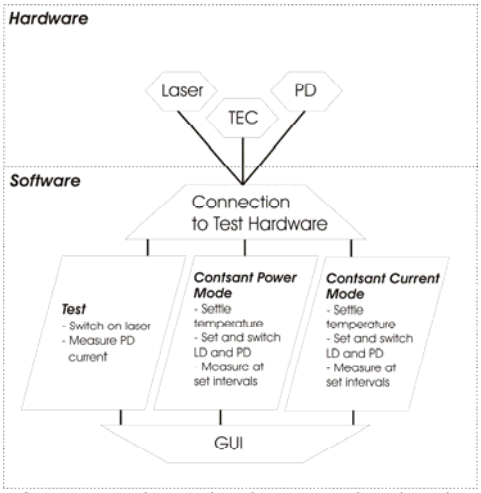

Figure 1: Schematic of system showing the Relationship between the hardware and the GUI.

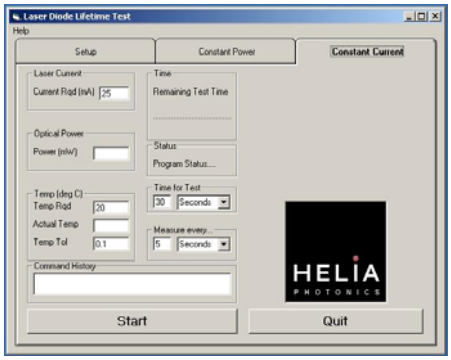

Figure 2: The GUI screen as seen during constant current operation.

Devices Under Test

Helia require the facility for lifetime testing of an assortment of laser diodes.

The Heriot-Watt group will initially test VCSEL arrays to confirm manufacturers' data sheets. These arrays are not commonly found in systems at present and are used by us as 1x12 arrays at 850 nm and as single devices in the visible. Additionally we intend to test microlens/VCSEL combinations based on our own microlens designs. Thermal issues are of paramount importance in optoelectronic datacomms, and have as yet been sparsely addressed in the literature.

The temperature variation of the lens, VCSEL structure will result in a shift in the optical properties of the combination. The nature and size of the shift is not known and is difficult to simulate or calculate. Experimental quantification is necessary before full system designs can be adopted. The shift is critical to the alignment of free space processing systems. Our systems generally use polarisation control, and the temperature stability of liquid crystal shutters is also being examined.

Conclusion

The optoelectronic lifetime test facility has been successfully constructed and commissioned. Fully specified operation has been achieved in mechanical, optical and electrical domains. The facility is of instant use from both commercial and research viewpoints.