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Methods of Direct Image Transmission

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A thesis
submitted in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy
at the
University of Auckland

University of Auckland

2001

UNIVERSITY OF AUCKLAND

-- APR 2002

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Abstract

Two interesting new methods for direct image transmission via optical communication channels are presented. In the first of these, the images are transmitted via a serial optical link using phase only encoding and decoding of the image. This is achieved by encoding the image using a set of binary phase sequences and sending the sum of the field from all the pixels through the link. The image is reconstructed by first spatially separating the beam into output pixels and impressing phase sequences conjugate to those used to encode the image onto each pixel. Then the output pixels are combined with a coherent reference beam and the resulting intensities are averaged over the length of the sequences to recover the image.

This method is discussed theoretically and it is shown that the number of image pixels able to be transmitted is limited by the dynamic range of the system. An experiment performed to demonstrate the principle of this technique is presented. This is done by transmitting a sixteen pixel image using a liquid crystal spatial light modulator to impart the phase sequences. Reasonably good image transmission is observed.

In the second image transmission technique the image is sent directly through a multimode optical waveguide. In this method the amplitudes of the waveguide modes are matched to those of the image pixels by sampling the image correctly and performing an appropriate transform. At the output, the waveguide modes are spatially separated into discrete pixels with amplitudes proportional to those of the original image pixels. This is done by performing another transform and sampling appropriately.

Image transmission through a perfectly reflecting slab waveguide and a dielectric slab waveguide is discussed theoretically. Experiments which demonstrate image transmission using this technique and highlight the difficulties encountered are also presented.

Acknowledgements

I have been very lucky to spend my time as a graduate student at the physics department of Auckland University. I could not wish to have done my research with a better bunch of people including both staff and my fellow graduate students.

I am very grateful to my supervisor, Prof. Tom Barnes. Tom is a very busy person with a very high work load, yet has always been able to find the time to help me with my work whether it was explaining how to use complicated bits of equipment, helping set up experiments or just finding things seemingly hidden in the lab. The discussions I have had with Tom on many different aspects of optics have been one of the highlights of my work over the last few years. Tom's encouragement and enthusiasm have helped make the research I have done with him so enjoyable.

I also thank Dr C.Y.Wu who originally thought of the mode matching idea which forms the bulk of this thesis. Dr. Wu is a gifted theoretician who I have very much enjoyed working with.

I would like to thank Tim Haskell at Industrial Research Ltd. who has helped by providing financial assistance throughout this project.

I thank Geoff Bold and Matthew Payton who have helped with proof reading. Especially to Geoff who has provided me with daily distractions which have made my time here much more fun than it would otherwise have been.

Lastly, I thank my mother for her love, support and understanding.

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