

An Indian-Australian research partnership

## Title: Automated Design and Configuration of Optical Networks

**Project number:** IMURA0078

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### Research Academy theme/s

List only the research academy theme/s that is relevant to the project

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure engineering

### The research problem

Growing demand for high-capacity communication networks and internet has stimulated rapid progress in optical fibre communication systems, to the point where link bandwidth is no longer a limitation. Several tens to hundreds of wavelengths can be sent down a fibre simultaneously (Wavelength Division Multiplexing: WDM), each wavelength carrying up to 40 Gbit/s, giving total capacities of several Terabits/s per fibre pair. These advances make optical communications the technology of choice for large capacity IP networks. However, due to the inherently analogue behaviour of optical fibres and other photonic devices used in optical fibre communication networks, designing or upgrading large scale optical fibre communication networks in a cost effective manner still remains a major challenge.

### The Project Aims

This project aims to improve the techniques used for designing, upgrading and deploying optical fibre communication networks. We aim to investigate exact and approximate techniques for designing complex optical networks that are practical and fast enough to configure subsystems in large optical networks in a few minutes, using currently available serial and parallel computing resources.

More specifically we aim to

- Devise exact and approximate optimal/quasi-optimal schemes for placement and configuration of subsystems and devices in optical communications network to overcome the inherent NP-hard nature (i.e. inability to solve exactly due to combinatorial explosion using conventional computing methods) using serial computing methods.
- Devise parallel/distributed computing algorithms to improve the performance of the algorithms resulting from the above step.
- Develop efficient serial and parallel computer codes to implement the above algorithms for placement and configuration of broadband optical fiber communications systems.

### Expected outcomes

- This project will look at new modelling and solution approaches that minimize cost and maximize quality of service in optical network design.
- The outcome of this research could ideally be used as a decision support tool for network design.