



## IEEE LEOS and IEAust ITEE College Lecture

### Title : **Optimal Network Design: An Application in Underground Mining**

**Presenter:** Professor Doreen Thomas  
Department of Electrical and Electronics Engineering,  
The University of Melbourne.

**Time :** 6:00pm refreshments for 6:30pm lecture  
Monday, 12<sup>th</sup> February 2007

**Location :** Auditorium, Engineers Australia Building, 21 Bedford St, North Melbourne  
There is no admittance fee for this talk and all are welcome.

**Contact Information:** For further information contact Dr Malin Premaratne  
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#### **Abstract :**

The mathematical problem of minimising the length of a network, known in the literature as the Steiner tree problem, has been applied to problems as diverse as telecommunications, VLSI chip design and irrigation networks. More recently, a team at the University of Melbourne have been applying theory they have developed on the three dimensional Steiner problem to the design of the layout of underground mining networks.

The dominant working structure of an underground mine is a set of interconnected tunnels for accessing the ore zones and hauling ore from these ore zones to the mill. This set of interconnected tunnels forms a network. An important constraint due to the trucks that haul the ore, is that the gradient of the mine ramps can typically be no more than 1:m, where m is in the range 6 to 9 depending on equipment used. The problem of minimizing the cost of developing and operating the mine is a network optimization problem.

In this talk I will discuss modelling this network optimisation problem and describe the software tools that have been developed for designing underground mine layouts that minimise costs. The application of these tools will be illustrated in two industry case studies. In the first we apply the Underground Network Optimisation tool to design an extension to an Australian gold mine where 15 new distinct ore bodies are located in a 3 km long region, several hundred metres underground. In a second case study, we design a single decline for accessing a large ore body at Olympic Dam, South Australia, where a turning circle constraint is a significant factor. An efficient decline is found using the Decline Optimisation Tool.

#### **Speaker Biography:**

Professor Doreen Thomas is Head of the Department of Electrical and Electronic Engineering at the University of Melbourne where she is also in charge of the Mathematics for Engineers program.

She received a B.Sc.Hons at the University of Witwatersrand, South Africa, then went on to graduate with an MSc followed by the D.Phil.Degree in Mathematics at St Anne's College, University of Oxford.

Her research in Optimal Network Design has applications in Telecommunications, VLSI design, Computational Biology and Underground Mining and she has worked on optimisation problems in all these areas. She leads a team of researchers and PhD students working at the University of Melbourne with research funding from the Australian Research Council and Newmont Australia Ltd. She has worked with a number of mining companies on their underground mine design.

She is an Associate Editor of the Journal of Combinatorial Optimisation and a Senior member of IEEE.