PIMS / AMI Seminar Series

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Tuesday, June 22, 2010
3:30 p.m.
CAB 657

"Mathematical Modelling of Atmospheric Contaminant Dispersion"

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Abstract

Atmospheric dispersion refers to the transport of contaminants in the atmosphere under the influence of advection (due to the wind) and turbulent diffusion. When the contaminant is emitted from a stationary point source, then the governing advection-diffusion equation may be solved analytically to obtain the "Gaussian plume" solution. This plume solution has been used to great advantage by environmental engineers, who have developed a variety of fast and robust numerical algorithms to calculate contaminant concentrations given known emission rates.

The main focus of this talk is the corresponding inverse problem, in which the emission rate must be estimated given measurements of contaminant particles deposited on the ground surface. I will present a study of a large mining operation which involved estimating pollutant emission rates for several sources distributed spatially over an actual industrial site. A least squares optimization approach is employed to estimate the sources, and the ill-conditioning of the inverse approach is discussed. This approach is general and can be applied to airborne particles that arise from a wide range of sources including biological agents (seeds and insects), natural hazards (volcanic eruptions and forest fires), and terrorist attacks (radioactive fall-out and infectious microbes).

Refreshments will be served in CAB 649 at 3:00 p.m.