AUTOMATION OF DEFORMATION MONITORING TECHNIQUES AND INTEGRATION WITH PREDICTION MODELLING

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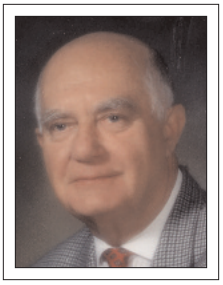
In 1965, the Department of Geodesy and Geomatics Engineering (formerly, Department of Surveying Engineering) at the University of New Brunswick initiated a specialization in engineering and mining surveying at the undergraduate and postgraduate levels. From the very beginning, a research program was initiated to develop new techniques and methods for high precision engineering and mining surveys including monitoring, modeling, and predicting structural and rock strata deformations in mines, tunnels, large dams, etc. The research program in deformation studies concentrated on 1) automation and integration of monitoring techniques, 2) development of methods for integrated analysis, modeling, and physical interpretation of structural and rock strata deformation using the finite element method (FEM). Significant progress has been made in both topics. The current trend in monitoring structural and ground deformations is to have fully automated, stand alone systems that can continuously collect and analyze the monitoring data. An ALERT Deformation Detection System (ALERT-DDS) is the latest development. The data are gathered, processed, and analyzed and alarms are generated in a fully automated mode.

En 1965, le Département de géodésie et de génie géomatique (anciennement, le Département de génie de l'arpentage) de l'Université du Nouveau-Brunswick a mis sur pied une spécialisation en génie et en levés miniers au niveau du premier cycle et des études supérieures. Dès le début, un programme de recherche a été mis en place dans le but de développer de nouvelles techniques et de nouvelles méthodes pour effectuer des levés d'ingénierie et des levés miniers de haute précision, y compris la surveillance, la modélisation et la prévision de déformations des structures et des couches rocheuses dans les mines, les tunnels, les grands barrages, etc. Le programme de recherche en études des déformations s'est concentré sur les thèmes suivants : 1) automatisation et intégration des techniques de surveillance, 2) développement de méthodes visant à intégrer l'analyse, la modélisation et l'interprétation physique des déformations des structures et des couches rocheuses en utilisant l'analyse par éléments finis (FEM). Des progrès importants ont été accomplis dans les deux domaines. La tendance actuelle de la surveillance des déformations des structures et des sols est de mettre en place des systèmes autonomes et entièrement automatisés qui peuvent collecter et analyser continuellement les données de surveillance. La plus récente avancée est le Système de détection des déformations ALERT (ALERT-DDS). Les données sont collectées, traitées et analysées et des alertes sont générées de façon entièrement automatique.



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1. Introduction

In 1965, the Department of Geodesy and Geomatics Engineering (formerly, Department of Surveying Engineering) at the University of New Brunswick (UNB) initiated a specialization in engineering and mining surveying at the undergraduate and postgraduate levels. From this, in 1965, an Engineering and Mining Surveying (EMS) research group was established. In 1969, the EMS group organized the First Canadian Symposium on Mining Surveying and Rock Deformation Measurements in Fredericton, NB. Recommendations developed at the symposium resulted in the creation of the Committee on Engineering and Mining Surveys at the Canadian Institute of Surveying and Mapping (currently the Canadian Institute of Geomatics).

From the very beginning, the research at UNB included the development of new techniques and methods for monitoring, modeling, and predicting structural and rock strata deformation and stress redistribution in underground and open pit mines, tunnels, large dams, and steep embankments. The developments may be divided into two main topics:

(1) integration and automation of monitoring techniques, and
(2) development and integration of methods for geometrical and deterministic modeling of structural and rock strata deformation, and development of prediction models of deformation.