



COLLABORATIVE RESEARCH CENTER 837

## INTERACTION MODELING IN MECHANIZED TUNNELING

RUB

# STRUCTURAL DIAGNOSIS AND MATERIAL MODEL CALIBRATION THROUGH INVERSE ANALYSIS: SOME INNOVATIVE PROCEDURES AND APPLICATIONS

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The purpose of this lecture is to show some recent research contributions, achieved by our team, to the methodology of inverse analysis apt for diagnosis of possibly damaged structures and for mechanical characterization of materials in diverse industrial environments. Research results are presented with reference to the real life engineering problems. First group of results considers diagnostic analysis of structures, with following industrial applications briefly presented: (a) diagnosis of pipelines and platforms by instrumented indentation test and fast simulations; (b) assessment of inelastic properties of large shafts through inverse analysis and experimental data collected from small punch test; (c) in-depth diagnostic analysis of aged concrete dams affected by diffusive mechanical deterioration by alkali-silicon reaction through

flat-jack tests and inverse analysis. Second group of results concerns calibration of complex constitutive models, described by large number of parameters, with reference to the following problems: (a) assessment of parameters entering into constitutive models employed for simulation of mechanical compaction of ceramic powders; (b) modeling damage in fiber reinforced concrete.

Presented examples demonstrate practical advantages in terms of time and resource savings that may be achieved by the employment of inverse analysis methodology. Heterogeneity in engineering application evidences the flexibility of methodology, suggesting that the applications in some other engineering fields can be easily accomplished by marginal modifications of presented techniques.

