US-Korea Workshop on

Smart Structural System

Coordinators

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Saturday August 24, 2002

Session S1 Passive and Active Control **09:00 – 11:10**

Chairmen: Barry J. Goodno and Hae-Sung Lee

Building Structures with Intelligent Hybrid Control and Soil-structure Interaction: F. Y. Cheng and X. Zhang, USA

LQR Control for Peak Response Reduction with Constraints on Failure Probabilities: K-W Min and J-H Park, KOREA

An Energy Framework for Decentralized Market-Based Structural Control: J. P. Lynch and K.H. Law, USA

State-of-the-Art of MR Damper-Based Control Systems in Civil Engineering Applications: H-J Jung, B.F. Spencer Jr., and I-W Lee, KOREA

Microvibtation Control of High Tech Facilities Using Hybrid Platform: Experiment and Analysis: Y. L. Xu, Hong Kong

Design, Fabrication, and Test of a Prototype Piezoelectric Friction Damper for Earthquake Response Mitigation of a Three-story Building: G. Chen, G. T. Garrett, J. Wu and F. Y. Cheng, USA

Development of Dampers and Seismic Isolators for Large Structures: D-H Kim, Y-S Kim, D-K Kim and J-W Park, KOREA

Coffee Break **11:10 - 11:30**

Session S2 Monitoring and Assessment I **11:30 - 13:00**

Chairmen: Daniel Kuchma and Ki-Soo Kim

Development of Bridge Monitoring Systems in Korea: S-G Kim, KOREA

A Wireless Embedded Sensor System to Monitor and Assess Corrosion in the Tendons of Prestressed Concrete Girders: D. Kuchma, J. Bernhard, and H. Reis, USA

A Wireless Structural Monitoring System with Embedded Health Monitoring Algorithms: J. P. Lynch, K.H. Law, A. Kiremidjian, E. Carryer, C.R. Farrar, H. Sohn, D.W. Allen, B.R. Nadler, and J.R. Wait, USA

Singularity Detection using Holder Exponents for Monitoring Structural Connections: H. Sohn, A.N. Robertson and C.R. Farrar, USA

Damage Estimation Method for Bridges Using Ambient Vibration Data: C-B Yun, J-J Lee, J-D Kim, and J-W Lee, KOREA

Lunch **13:00 - 14:20**

The Role of Regularization Functions in Various Structural System Identification Problems

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Abstract

System identification (SI) algorithms have been widely used for the last few decades in the area of structural engineering to identify mechanical systems and to detect damage in structures. However, SI algorithms based on the minimization of the least squared error between measured and computed responses suffer from inherent instabilities caused by the ill-posedness of inverse problems. The instabilities are characterized by the non-uniqueness and discontinuity of solutions. In particular, when measured data are polluted with noise or when a finite element model used for the SI does not represent actual situations, the instabilities become very severe.

To overcome the instabilities of inverse problems, the regularization technique has been utilized. In a regularization technique, a regularization function is introduced as additional constraints to define the solution space of a system identification problem. Therefore, the regularization function should be selected so that physical and mathematical characteristics of the given problem can be properly represented.

This paper reviews various types of regularization functions that have been successfully applied to structural system identification problems. Two different regularization techniques – Tikhonov regularization scheme and truncated singular value decomposition – are considered to imposed the regularization functions. The role of a specific regularization function in a SI scheme is discussed in detail, and several algorithms to obtain well-balanced regularization effect in parameter estimation are also presented.