

MATERIAL PROPERTY IDENTIFICATION AND SENSITIVITY ANALYSIS USING INDENTATION AND FEM

Long Ge - Mechanical & Aerospace Engineering
Nam Ho Kim – Material Science & Engineering
Gerald R. Bourne - Mechanical & Aerospace Engineering
W. Gregory Sawyer - Mechanical & Aerospace Engineering

UNIVERSITY OF FLORIDA

**Proceedings of IDETC/CIE 2006
ASME 2006 International Design Engineering Technical Conferences &
Computers and Information in Engineering Conference
September 10-13, 2006, Philadelphia, Pennsylvania, USA
DETC2006-99329**

ABSTRACT

Mechanical properties of materials in small-scale applications, such as thin coatings, are often different from those of bulk materials due to the difference in the manufacturing process. Indentation has been a convenient tool to study the mechanical properties in such applications. In this paper, a numerical technique is proposed that can identify the mechanical properties by minimizing the difference between the results from indentation experiments and those from finite element analysis. First, two response surfaces are constructed for loading and unloading curves from the indentation experiment of a gold film on the silicon substrate. Unessential coefficients of the response surface are then removed based on the test statistics. Different from the traditional methods of identification, the tip geometry of the indenter is included because its uncertainty significantly affects the results. In order to validate the accuracy and stability of the method, the sensitivity of the identified material properties with respect to each coefficient is analyzed.

Ge, L., Bourne, G.R., Kim, N.H., and Sawyer, W.G., (September 2006), "Material Property Identification and Sensitivity Analysis Using Indentation and FEM", Proceedings of IDETC/CIE 2006 (Paper No. DETC2006-99329), ASME 2006 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, September 10-13, 2006, Philadelphia, Pennsylvania.