

# Department of Systems Engineering and Engineering Management

## Seminar Series

### **Predictive Maintenance Using Neural Networks For Airport People Mover Vehicles**

**Dr. Alice E. Smith**

W. Allen and Martha Reed Professor  
Auburn University, USA

Date	16 July 2014 (Wednesday)
Time	10:30am (Tea/Coffee service at 10:15am)
Venue	B6619, 6/F, AC1

#### **Abstract**

This talk describes a case study of the development and testing of a prototype system to support condition-based maintenance of the door systems of airport transportation vehicles. These “people mover” vehicles are found in airports around the world and must meet stringent availability requirements. This has caused over maintenance of the vehicles while still allowing for failures.

To address this issue, a predictive maintenance system was developed to monitor the state of the vehicle doors and signal when maintenance is needed. Every door open/close cycle produces a “signature” that can indicate the current degradation level of the door system. A combined statistical and neural network approach was used. Time, electrical current and voltage signals from the open/close cycles are processed in real time to estimate, using the neural network, the condition of the door set relative to maintenance needs. Data collection hardware for the vehicle was designed, developed and tested to monitor door characteristics to quickly predict degraded performance, and to anticipate failures.

The benefits anticipated using predictive diagnostics over a scheduled maintenance approach are: 1) more cost effective maintenance because system and/or components are maintained only where and when needed and 2) degradation-type failures and downtime reduced to a minimum because

systems and their components can be maintained during an early phase of degradation, long before failure can occur.

The prototype system was installed on vehicle door sets at the Pittsburgh International Airport and tested for several months under actual operating conditions. The findings included: 1) the idea of predictive maintenance for degradation-type behavior is technically sound, 2) it is possible to design, build and implement a predictive maintenance system for doors without major design changes and without significant investment, 3) empirical modeling does appear to be practical and effective, and 4) analytic modeling does not appear to be practical and therefore traditional model based approaches will probably fail.

This project was joint with Daimler Research in Germany and Adtranz (now, Bombardier) company in Pittsburgh, Pennsylvania. The project resulted in a U.S. patent and several international patents.

### **About the Speaker**

**ALICE E. SMITH** is the W. Allen and Martha Reed Professor of the Industrial and Systems Engineering Department at Auburn University, where she served as Department Chair from 1999-2011. She also has a joint appointment with the Department of Computer Science and Software Engineering. Previously, she was on the faculty of the Department of Industrial Engineering at the University of Pittsburgh from 1991-99, which she joined after industrial experience with Southwestern Bell Corporation. Dr. Smith has degrees from Rice University, Saint Louis University and Missouri University of Science and Technology.

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*All are Welcome!*