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Research Highlights

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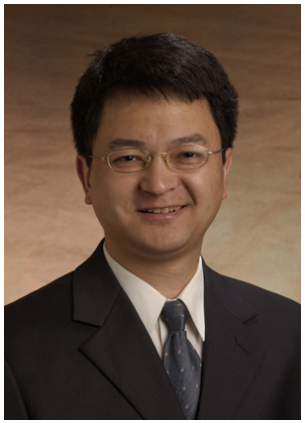

• Dr. Haitao Liao, Assistant Professor

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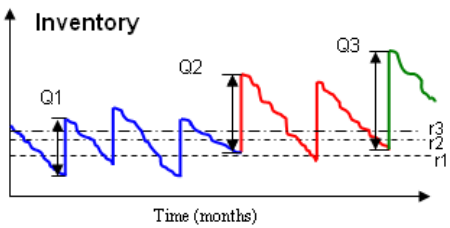
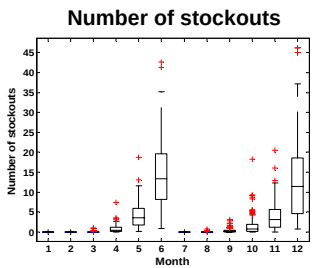
- **Research interests:** **Reliability Testing, Maintenance and Spare Part Logistics, Prognostics, Risk Assessment**
- **Recent projects**
  - PI: "CAREER: Adaptive Operational Coordination Methodology for Uncertainty Reduction in Product Life Cycle Reliability and Service Logistics", ***National Science Foundation***, 2010-2015.
  - PI: "Exploration of a Statistically Accurate and Energy Efficient Accelerated Testing Methodology ", ***National Science Foundation***, 2010-2013.
  - PI: "Design of Equivalent Accelerated Life Testing Plans Involving Single or Multiple Stresses", ***National Science Foundation***, 2006-2009.
- **Recent publications**
  - Mitch, R. and Liao, H. "**Joint Production and Spare Part Inventory Control Strategy Driven by Condition Based Maintenance**", *IEEE Transactions on Reliability*, accepted, 2010.
  - Liao, H. and Elsayed, E. A., "**Equivalent Accelerated Life Testing Plans for Log-Location-Scale Distributions**", *Naval Research Logistics*, accepted, 2010
  - Liao, H., "**Optimal Design of Accelerated Life Testing Plans for Periodical Replacement with Penalty**", *Naval Research Logistics*, 56, 2009.
  - Liao, H. and Elsayed, E., "**Reliability Inference for Field Conditions from Accelerated Degradation Testing**", *Naval Research Logistics*, 53, 2006.

Integrated Reliability Maintenance & Service (IRMS) System

Spare part inventory control system





Service

Service Logistics

Spare parts management

Maintenance

Decision support

Preventive maintenance

Condition based maintenance

Reliability Testing

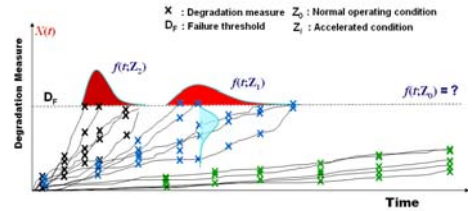
Accelerated life testing

HALT

degradation testing

R&D

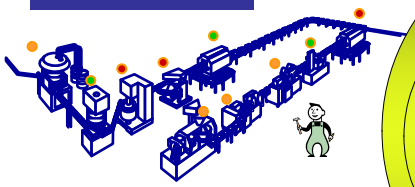
Use of short-term reliability testing to predict the long-term reliability of equipment



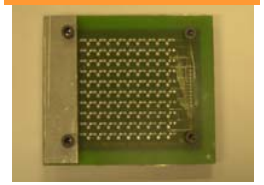
$X(t,Z,\Theta) \Rightarrow R(t,Z,\Theta) = \Pr(X(t,Z,\Theta) < D_F)$

Manufacturing system

- Good condition
- OK condition
- Bad condition

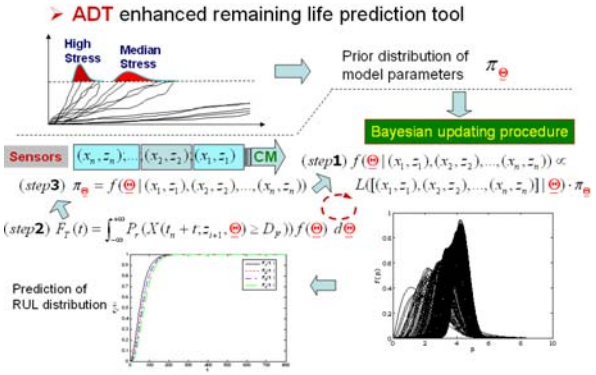


Printed circuit board



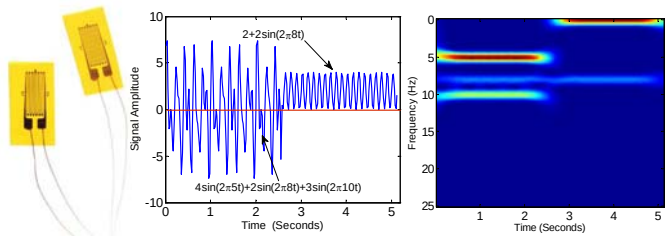
Microelectronics

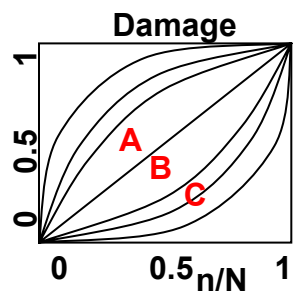
Equipment remaining useful life prediction

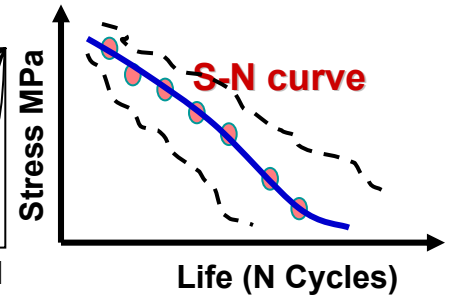


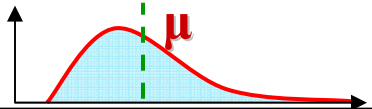
Environmental testing

Advanced Life Prediction Tool









Joint Time-Frequency Analysis

Advanced Cumulative Damage Model (Stress-Life/Damage Model): D=F(n, σ, freq, temp, moisture)

Σ

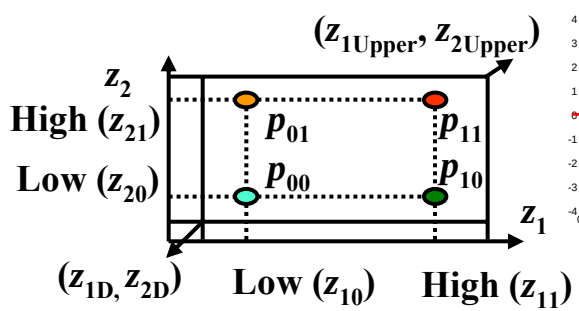
Predicted Fatigue Life Distribution

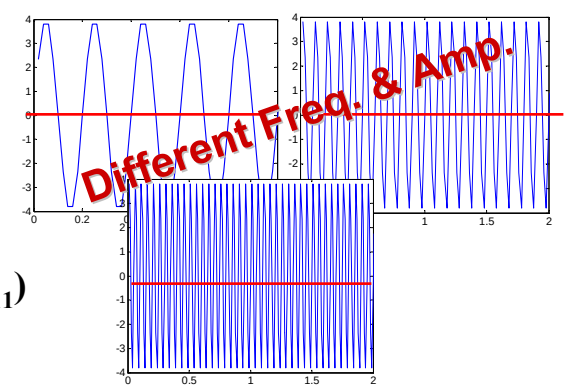
Instrumented Device

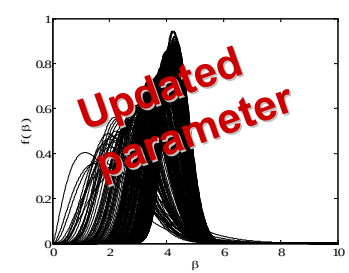
Design of Experiments (DOE)

Accelerated Life/Degradation Testing

Bayesian Updating







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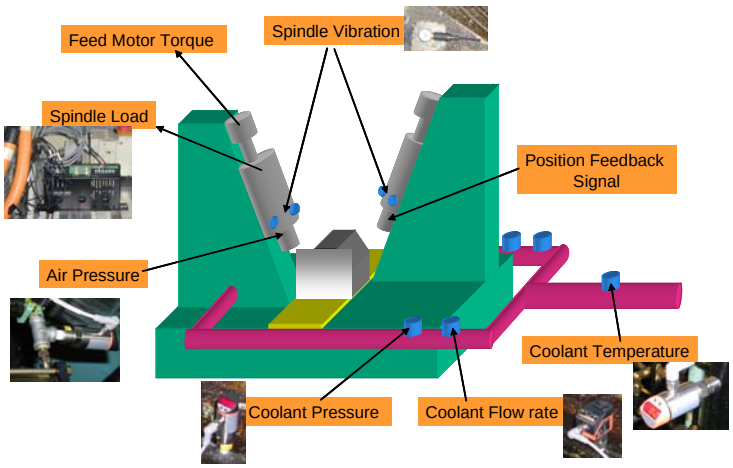
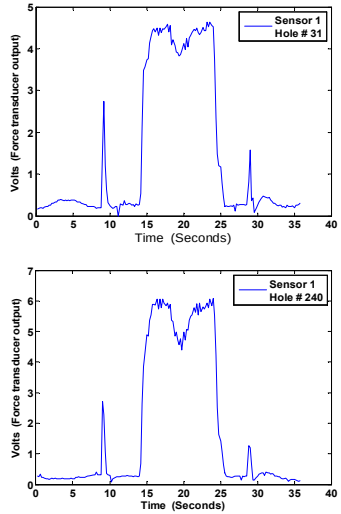
Maintenance & Spare Part Logistics through Condition Monitoring

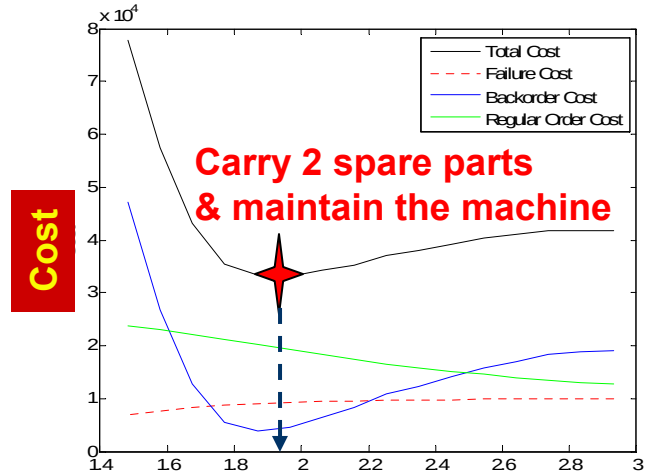


Machine

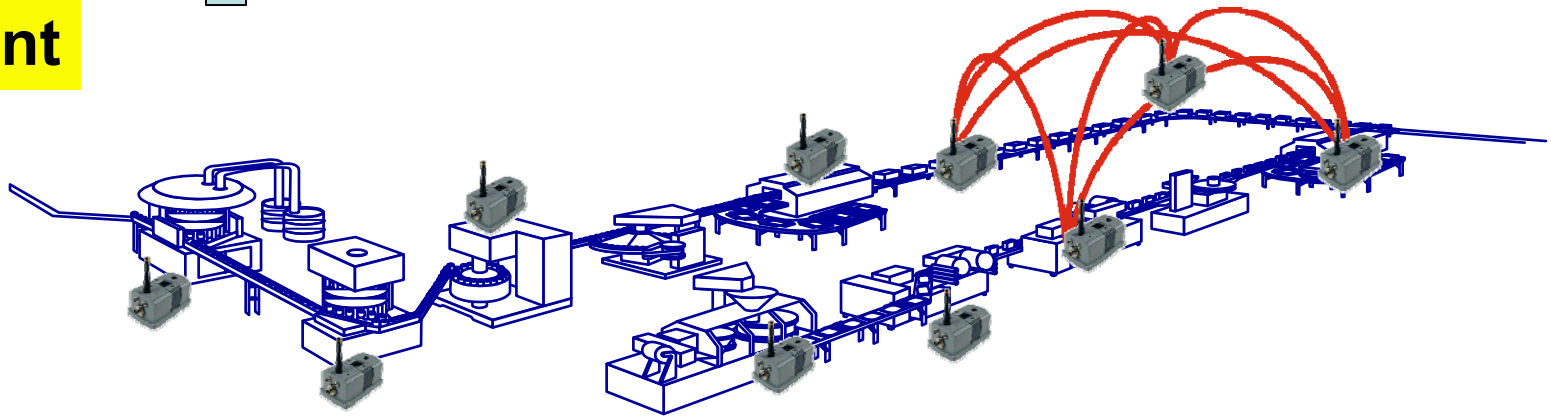
Spindle load



Spare part & maintenance decision



Plant



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