MAINTENANCE LOGISTICS

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PRESENTER OUTLINE

» Motivation
» Previous Work
» Research Plan
MOTIVATION

» Maintenance as a Process
  § Optimized condition monitoring
  § Sensors
  § Degradation modeling
  § Fault detection
  § Process control

» A systems approach
  § Coordinated
  § Integrated
  § Explicit quantification of tradeoffs
  § Conflict resolution

» Optimized maintenance performance should not come at the expense of intra and inter-facility logistics and efficiency

» Needed coordination across areas of the factory, across time periods, across functional areas
MOTIVATION

» Condition-Based Hardware Support
» Resource Allocation and Optimization Supporting the New Developments on Maintenance
  § Spare parts and subassemblies
  § Consumables
  § Technicians
  § Maintenance tools and equipment
» Maintenance Supply Chain Design
  § Transportation
  § Distribution
  § Stocking
» Real-time Maintenance Planning and Scheduling
  § Given the parts, consumables, technicians, and maintenance tools,
  § Given the maintenance requests from dispersed points,
  § How do we plan, schedule and dispatch resources
PREVIOUS WORK

» Service Parts Logistics Network Design and Inventory Management

» Service Parts Repair Resource Allocation and Inventory Management

» Effects of Advanced Process Control on Production Scheduling

» Integrated Production Scheduling and Condition-based Maintenance Scheduling
PREVIOUS WORK

» Service Parts Logistics Network Design and Inventory Stocking

» Existing install base dispersed geographically
  § Across the globe
  § Across the factory

» Spare parts, technicians, maintenance tools to be dispatched from the network locations to install bases in need

» Time-based service levels
  § Provide service within 2 hr, 4 hr, etc.
  § Minimize the critical equipment downtime

» Where should we stock parts in the network?
  § Network design

» How much should you stock in the network?
  § Inventory stocking

» Control the total facility, transportation and inv
» Multi-Echelon Level of Repair Analysis and Spare Parts Stocking

» As parts fail, decide which parts at what levels of the product structure should be repaired and which parts should be discarded
  § Repaired parts resupplied to the stocking locations
  § Discarded parts lead to new part replenishments

» Position repair and maintenance tools across the network locations
» Decide stock levels and inventory policies
PREVIOUS WORK

Production Scheduling with Advanced Process Control Constraints

Schedule jobs of different types with setup times while considering advanced process control requirements

- Motivated by semiconductor manufacturing
- APC: qualification runs
  - If it has been a while since the last run of wafer type A, schedule a qualification run to qualify the machine
  - Can avoid qual runs if the runs of different types are mixed frequently

What is the best schedule for jobs and qualification runs
Consider the new degradation dynamics models within maintenance planning and scheduling models
Incorporate new models of degradation and maintenance into logistics models including spares stocking
Expand the focus on maintenance to include multiple sites, multiple equipment, geographically dispersed install base
Explicitly model spatial considerations (distances between maintenance personnel, tools and target systems)
Consider the limited quantity and capacity of maintenance and repair resources
POTENTIAL APPLICATIONS

» Heavy Machinery and Equipment
  § Construction
  § Mining
  § Manufacturing
» Medical Equipment
» Energy/Power Generation Equipment
» High-tech and High-End Electronics
» Defense and Transportation
  § Aircraft
  § Ships
  § Automotive
SUMMARY OF PROPOSED WORK

Task 1: Incorporate new degradation models into maintenance planning, scheduling
Task 2: Integrate maintenance logistics for parts and tools, and consider spatial issues and resource capacities and quantities
Task 3: Implement the proposed tool at an actual system

Integrated maintenance logistics, planning and scheduling model with spatial considerations
Develop solution methodologies for integrated models
Prototype decision support tool

• Mentors: Prof. Erhan Kutanoglu & industrial partners
• Researchers: One graduate student per application area (possible application areas include manufacturing equipment, heavy machinery, power generation, medical equipment, etc.)

Ability to include maintenance logistics into process and condition based maintenance activities
Ability to coordinate activities and decisions across functional areas, locations, equipment

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BUDGET SUMMARY

» Year 1
  • Model and method development in an application area
  • 40K (student tuition and stipend for a year)
  • Additional applications in similar areas
  • Additional 20K (student tuition and support for 6 months)

» Year 2
  • Model and method development in the application area
  • 40K (student tuition and stipend for a year)
THANK YOU