Self-introduction and PhD plan

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03.11.2017
CONTENT

1. Self-Introduction
2. Previous work
3. PhD plan
Introduction

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Education

Master’s degree Institution:
China University of Petroleum-Beijing
College:
Mechanical and Transportation Engineering
Major:
Safety Science and Engineering
1. Self-Introduction
2. Previous work
3. PhD plan
Previous work

**Research Focus:**
Offshore well control equipment reliability and integrity assessment

**Master’s thesis topic:**
Evaluation Method of Offshore Blowout Preventer Integrity Assessment Based on Risk Assessment
1. **Project Title:** Risk Control of Deepwater Gas Field Drilling and Completion Options

   **Brief:** Researching on the evaluation of BOP reliability

   - Risk Analysis
     - FMEA
     - RPN
     - The FMEA-RPN analysis of Subsea BOP system
     - The FTA analysis of Critical Equipment

   Safety Evaluation of Subsea BOP
Inner cavity erosion of RAM BOP

The flange under the non-uniform bolts pre-tightening
2. Project Title: Non-metallic materials and safety monitoring technology

Brief: Researching the corrosion and erosion mechanism of high pressure manifold key components; Researching the main influence factors of the mechanism of corrosion and erosion.

Testing method:
Metal magnetic memory

Main influence factors:
- Impacting Velocity
- Tensile Stress
- Impacting angles
- Materials
3. **Project Title:** Assessment Technology Research of Well Control Equipment  
Brief: Researching on the evaluation of **BOP reliability and integrity**;  
Developing the software of well control equipment integrity management.

**BOP integrity**

- Structural integrity
- Functional integrity

**BOP integrity** ↔ **Integrity evaluation index system**

- Human  
- Machinery  
- Environment
Integrity management software
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Research plan

Topic: Hybrid prognostics and health management for safety-critical systems in infrastructures

- supervisor: Yiliu Liu
- co-supervisor: Anne Barros

Key words: Prognostics and health management (PHM)
- safety barriers
- safety-critical systems
- Mostly in a **dormant** mode
  - gives **uncertainty** about their operationality when demanded
- **Periodically** tested or inspected
  - periodic tests and inspections are inaccurate;

About **33%** of failures per year of fire suppression systems was the result of an inadequate inspection*.

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* D. Dieken, Inspection, testing and maintenance of fire protection systems at industrial plants, Process Saf Prog 18(1999),151-155.
Four quadrant chart for identifying systems

- Quadrant 1: Noticed and fixed during the design stage
- Quadrant 2: More spare parts
- Quadrant 3: Regular maintenance
- Quadrant 4: Prognostics/predictive maintenance

Fault frequency vs. Average downtime chart
## Maintenance types characteristics

<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Reactive</th>
<th>Preventive</th>
<th>Predictive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>On demand</td>
<td>Scheduled, time- or cycle-based</td>
<td>Condition based</td>
</tr>
<tr>
<td>Labor cost</td>
<td>high</td>
<td>high</td>
<td>Low</td>
</tr>
<tr>
<td>Labor utilization</td>
<td>high</td>
<td>Low</td>
<td>low</td>
</tr>
<tr>
<td>Parts cost</td>
<td>high</td>
<td>medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Throughput impact</td>
<td>high</td>
<td>medium</td>
<td>Low</td>
</tr>
<tr>
<td>Urgency (Acceptable resolution timeframe)</td>
<td>High (minutes to hours)</td>
<td>low (days to weeks)</td>
<td>Very low (depends on impact)</td>
</tr>
</tbody>
</table>

Challenges:

1. Observation of degradation for safety-critical systems
   - Assume the degradation as exponential distribution

2. Evolving environment (EE)
   - EE changes the conditions, degradation and failure occur.

3. Uncertainty
   - obtain component failure rates
   - Reliability information for systems especially in a dormant mode

An illustration of traditional degradation-threshold failure
Thanks for your attendance!