PHM Society- Education and Professional Development

Taxonomy Development Workshop
Thursday 900 – 1030 am

Chairs
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PHM Needs

1) PHM is a diverse, multi-disciplinary domain with rapidly evolving capability needs.

2) Initial education and training from many discipline entry points must be complemented by specialized and professional development over a career.

3) Benchmarks are needed for career planners, employers and training developers to facilitate transitions between mastery levels.

4) Stakeholders ensuring a stream of qualified practitioners include academia, industry and government.
Proposal

To compile a PHM Taxonomy mapping:

a) Skill/capability areas
   e.g. Signal processing, statistics, control systems, [as rows]

b) Competency level descriptors:
   Entry, Working or Mastery for each [as columns]
Why

**Employers:** A job description to include a capabilities list from various areas with desired mastery levels. Evaluation schemes could reference mastery levels to be demonstrated or developed. Professional development transitions could be defined and matched to courses or in-house assignments.

**Practitioners for career planning:** Plan education and professional development progressions and understand skills and capabilities required.

**Training and professional development course developers:** Identify niche areas and descriptors for likely pre-requisites available and new competencies to be acquired.
**Competency Levels**

**Entry Level:** Understands, selects, interprets and applies basic concepts and known methods. May work at the sub-system level.

**Working Level:** Analyses and solves complex problems by combining or extending existing methods. Integrates and validates at the system level.

**Mastery Level:** Evaluates, innovates, synthesizes and validates new methods through unique, often multi-disciplinary insights.

May include analysis, design, build/implement and test for equipment, hardware and software.
Skills/Capabilities

**PHM skills/capabilities**

- **Domain**: major category of a technical skill or competency
- **Sub-domain**: constituent sub category that could be associated with a stream of graduate courses
- **Specialty**: subject that could constitute a specific course
<table>
<thead>
<tr>
<th>PHM domain</th>
<th>Sub-domain</th>
<th>Specialty</th>
<th>Entry Level descriptors</th>
<th>Working Level descriptors</th>
<th>Mastery Level descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytics</td>
<td>Diagnostics</td>
<td>Methods</td>
<td>Apply existing single and multi-disciplinary methods</td>
<td>Assess shortcomings in existing methods-adapt/hybridize methods to suit</td>
<td>Develop new methods from novel physics or mathematical insights</td>
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<tr>
<td></td>
<td></td>
<td>Metrics</td>
<td>Other</td>
<td>Other</td>
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<td></td>
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<td></td>
<td>Apply appropriate existing metrics</td>
<td>Adapt metrics to complex system evaluation</td>
<td>Devise and bring into acceptance system level metrics</td>
</tr>
</tbody>
</table>
1. System physical modeling
2. Data Modeling
3. Analytics
4. Test and Experimental (Design and conduct)
5. Software Systems
6. Hardware Systems
7. Life Cycle Analysis
8. Verification and Validation
9. Human Factors
10. System Engineering
11. Cost Benefit Analysis
12. Certification
13. Standards
14. Digital Transformation (new)
Domains to work

3. Analytics
   a. Data pre-processing
   b. Feature extraction
   c. Feature selection
   d. Classification- methods, metrics
   e. Regression- methods, metrics
   f. Optimization- methods, metrics
   g. Model Fusion
   h. Anomaly Detection
   i. Fault Isolation- observability, coverage
   j. Prognostics- specialized methods, metrics (e.g. latency)
   k. Data Fusion by data types
   l. Special Issues with time series data
   m. Special Issues with nominal data types
   n. Reasoners- meta-classifiers, Bayesian, fuzzy logic
   • Note: Diagnostics is considered as e-i

7. Life Cycle Analysis
   a. RCM and systems framework
   b. Advanced reliability approaches
   c. Data issues
   d. Integration issues
   e. Support Service/Performance Based Logistics approaches

8. Verification and Validation
   a. Needs analysis
   b. Risk Analysis
   c. Metrics, uncertainty/confidence and evaluation
   d. Methods
Workshop with small groups

1. Review /revise sub-domains for your Chosen domain
2. Develop some descriptors for some of the sub-domains:
   a. Entry level capabilities
   b. Working level capabilities
   c. Mastery level capabilities
3. Identify people to continue development
   a. Working group,
4. Identify approaches to spread the word
   a. Continuing Professional Development, company teams, courses

Remember the stakeholders/users:
Employers, practitioners (career planning), Educators/Trainers
All for application in Continuing Professional Development