Accueil Professeur Invité ENSMM
FEMTO-ST, AS2M, équipe PHM

Abhinav Saxena, PCoE, NASA Ames

Courte biographie et résumé des interventions

Objet

L'ENSMM accueille M. Abhinav Saxena, chercheur au sein du Prognostics Center of Excellence de la NASA du 03 au 17 juin. Dans ce cadre, M. Saxena assurera trois séminaires pour des publics différents. Toute personne intéressée est bien entendu invitée à y participer.

1. Séminaire ENSMM
   - Jeudi 06 juin 2013, 14h-16h, amphithéâtre Jules Haag, ENSMM
   - Thème : activité du PCoE de la NASA, collaborations industrielles et internationales
   - Public visé : étudiants et personnel intéressé
2. Séminaire FEMTO-ST
   - Vendredi 07 juin 2013, 10h30h-12h30h, amphithéâtre FEMTO-ST
   - Thème : Prognostics & Health Management, problématiques, challenges scientifiques, exemples
   - Public visé : chercheurs, enseignants chercheurs, doctorants
3. Séminaire FCLAB
   - Vendredi 14 juin 2013, 10h30h-12h30h, FCLAB
   - Thème : Prognostics & Health Management de systèmes électrochimiques
   - Public visé : chercheurs, enseignants chercheurs, doctorants

Le reste du temps de visite de M. SAXENA sera principalement consacré à du travail conjoint avec les membres de l'équipe PHM (département AS2M), et au renforcement de l'activité partenariale déjà existante.

Vous trouverez ci-après une courte biographie de Abhinav Saxena ainsi qu'un résumé des séminaires programmés.

Abhinav SAXENA, research scientist, NASA Ames

Abhinav Saxena is a Research Scientist at the Prognostics Center of Excellence, NASA Ames Research Center, Moffett Field CA. He has been involved in the field of IVHM since 2003 and has published over five dozen research articles in scientific journals and conference proceedings including several book chapters. His research focus lies in developing and evaluating health management algorithms for engineering systems such as electromechanical actuators, electronic semiconductor devices, composites structures, and power storage devices. These algorithms apply various classification, regression, and state estimation techniques for predicting remaining useful life of systems and their components. He is also working on developing systems engineering process and methods for verification and validation for health management systems. Abhinav has actively participated in IVHM community through his various roles as conference chairs and as part of working groups for various standards and documents on topics related to IVHM. He received Distinguished Service Award in from the PHM Society in 2012 for his continued service to the community. He is a contributing member of SAE HM-1 IVHM and E-32 committees. He is currently the chief editor of the International Journal of Prognostics and Health Management (IJPHM). He has a PhD in Electrical and Computer Engineering from Georgia Institute of Technology, Atlanta. He earned his B.Tech. in 2001 from Indian Institute of Technology (IIT) Delhi, and Masters Degree in 2003 from Georgia Tech. Abhinav has been a GM manufacturing scholar and is also a member of PHM Society, IEEE, AIAA, and ASME.

1. Prognostics & Health Management – Challenges and Research Activities at PCoE NASA

Jeudi 06 juin 2013, 14h-16h, amphithéâtre Jules Haag, ENSMM

Prognostics Center of Excellence at NASA Ames Research Center is one of the leading centers for researching and developing prognostic methods as applied to aerospace systems. The center takes pride in identifying, defining, and tackling key challenges in maturing PHM technologies through a portfolio of diverse applications. A brief overview of the center's goals and research portfolio will be followed by more detailed technical approaches presented by means of various case studies. The case studies will include individual component level prognostics algorithm development efforts as well as system level health management work. Specifically ongoing efforts on component level prognostics for composite structures, electromechanical actuators, power semiconductor devices, capacitors, Li-ion batteries, etc. will be shown. The importance of looking at decision making beyond prognostics will be discussed as the next step towards maturation and certification. Examples will include electric-UAV and terrestrial rover test platforms.

2. Prognostics and Health Management – An Emerging Systems Engineering Discipline

Vendredi 07 juin 2013, 10h30h-12h30h, amphithéâtre FEMTO-ST

In last couple decades, Prognostics and Health Management (PHM) has emerged as a dedicated systems engineering (SE) discipline to maintain safety, reliability and maintainability of the systems. Specifically, depending on the target sector the value proposition resides in focusing on improving the safety, reducing the life-cycle costs, or both. In the industrial sector this becomes relevant in improving fleet centric monitoring and maintenance practices especially when the business models are shifting from "selling equipment" to "selling services". On the other hand safety and reliability become central issues when it comes to aerospace systems where the fleet sizes are relatively small or even "one" for most space applications. The specific approaches employed in two situations are often very different but revolve around once common theme of monitor, detect, predict, and decide. Recent literature on PHM methods shows adoption of several different definitions, which often interpret PHM in different ways and sometimes creates confusion due to lack of common terminology to describe methods and application goals. For instance, individual time scales and criticality for each of these elements differ from case to case basis and that's what makes PHM a rather customized solution given any application. In this talk a brief overview of PHM value proposition will be presented. PHM is seen as a composite function or capability encompassing both hardware and software components for instrumentation, monitoring diagnosis, prognosis, and decision making. Several approaches will be outlined briefly that carry out each of these functions, with special emphasis to Prognostics methods. Concepts based on model versus data-driven methods will be presented. Further, some recent research initiatives will be discussed that aim at tackling fundamental research issues associated with deployment of PHM in the industry. These challenges encompass both programmatic and technical issues, which would be discussed with associated current research activities.

3. Prognostics and Decision Making for Li-ion Batteries and its Application in Electric-UAVs

Vendredi 14 juin 2013, 10h30-12h30, FCLAB Belfort

Failure prognostics is aimed at assessing the current state of component degradation and predicting the remaining useful life of a component, after which it will no longer perform its intended function within desired specifications. Prognostics implementations in critical aerospace systems enable mission replanning or reconfiguration decisions to be made on the fly based on online estimates of current system health and the predicted deterioration of a system over a proposed mission. A novel battery health management technology utilizing prognostic information is under development for the long-life, high-density, and easily scalable battery power systems that are being used on a new generation of electric unmanned aerial vehicles (e-UAV). Online production of prognostic estimates requires low computational complexity models of component degradation or fault evolution. Models of the basic electrochemical processes of a Lithium-ion battery combined with a real-time updated Bayesian inference framework is used to simultaneously track battery state-of-charge as well as tune the battery model to make accurate predictions of remaining useful life. Several experiments were designed to age 18650 Li-ion cells in controlled environments under various conditions to aid in model development. It was shown that empirical models aided with measurement data are able to predict end of discharge time with good accuracy across different battery chemistries. The level of abstraction in battery prognostic models has allowed reuse in different chemistries of Li-ion and even Li-Po batteries. Experiments and model development activities will be described from this effort and results from some of the e-UAV application will be presented. Furthermore, extending the same approach to the modeling of various fault modes in Li-ion cells is under investigation. Some observations from experiments designed for fault injection in Li-ion cells will be presented.