



**Seminar November 15 & 16, 2022 – Nancy, France
Health Aware Control Design in Aerospace Domain
Polytech Nancy – ROOM A206**

Organizer(s):

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under the support of M3 and IA2R Polytech Nancy - Prof. P. WEBER and Prof. H.
GARNIER(*)

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Location: Polytech Nancy, 2, rue Jean Lamour 54509 VANDOEUVRE-LES-NANCY
(<http://polytech-nancy.univ-lorraine.fr/fr/content/venir-polytech>)

Abstract: The domain of prognostics and health management (PHM) deals with assessment of state of health of system/component as well as prediction of Remaining Useful Life (RUL) has sufficiently matured in last decade leading to development of various approaches based on physics-based model, data-driven as well as hybrid approaches that blend the advantages of the former two. As almost all industrial and mission critical systems operate in closed loop, it has become imperative to develop control laws that lead to a reasonable system performance as well as guarantee desired levels of Remaining Useful Life (RUL) of the global system. In this context, health-aware control (HAC) has recently emerged as one of the domains where control synthesis is sought based upon current state of health and failure prognostics. Similar approaches are being developed in the domain of Prognostics and Health Management (PHM) to improve online and post-prognostic decision making capabilities. Recent advances in the field of Artificial Intelligence, particularly in the areas of Deep Learning and Reinforcement Learning (RL) have shown remarkable breakthroughs respectively, in data-driven based prognostics in supervised as well as unsupervised setting, and execution of (near) optimal control policies in absence of model knowledge (i.e., using model free approaches). RL based algorithms have seen a rapid surge in research mainly due to their ability to learn optimal control policies offline and online based on interactions with the environment, in model-based as well as model-free settings leading to successful applications focused on aerospace domain but not only.

This seminar is devoted to present the latest results obtained in these research areas, the different research works in progress, and the recent attempts to apply them in aerospace domain. On the top of the different lectures, two round tables will leave the opportunity for open discussions on the emerging challenges.



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Tuesday 15 November:

- 14h00-14h05: Welcome Ceremony (CRAN / CNES / Polytech Nancy)
- 14h05 - 14h45: Dr. J. THULLIER – CRAN/CNES
“Health Aware Control Design for Reusable Cryogenic Liquid Rocket Engines”
- 14h45-15h25: Prof. G. HOBLOS – ESIGELEC
“A Model-Based Prognostics Approach for RUL Forecasting of a Degraded DC-DC Converter”
- 15h25-16h05: Dr. E. KURUDZIJA – Deutsches Zentrum für Luft- und Raumfahrt,
“Machine Learning Based Health Monitoring and Control at DLR”
- 16h05 – 16h20: *Coffee Break*
- 16h20-17h00: Mr. Louis THIOULOUSE – ONERA
“Health and Usage Monitoring of Aerospace Systems Health and Usage Monitoring of Aerospace Systems: Measurements / Data / Models: Measurements / Data / Models”
- 17h00-17h40: PhD Student A. VENNITTI, Dr C. BACH – Technical University Dresden
“Data-based anomaly detection for predictive maintenance”
- 17h40-18h10: Dr. P. DO – CRAN
“Degradation modelling and accelerated testing optimization for optoelectronic components”
- **18h10 – 18h40 Round table on HMS needs in Liquid Propellant Rocket propulsion – Mr. M. GALEOTTA**

19h30 – 23h00: Diner Restaurant in City Center– (Self-paid) – Schedule has been modified

Wednesday 16 November:

- 08h40 – 09h20: Prof. J.J. MARTINEZ-MOLINA - Gipsa Lab
“Degradation-aware control, RUL control & Reliability adaptive systems”
- 09h20 – 10h00: PhD Student M. HERVE de BEAULIEU – CRAN
“Unsupervised Remaining Useful Life Estimation Based on Deep Virtual Health Index Long-range Prediction”
- 10h00 – 10h15: *Coffee Break*
- 10h15 – 10h55: Dr. M.S. JHA – CRAN
“Control Learning for safety-critical systems”
- 10h55 – 11h35: Mr. S. LE GONIDEC – Ariane Group
“Advancements in HMS and prognostic activities in last decade at AGS Vernon”
- **11h35 – 12h05 Round table on prognostic and predicting maintenance in Liquid Propellant Rocket propulsion – Mr. S. LE GONIDEC**
- 12h05 – 12h15: *Closing Ceremony*

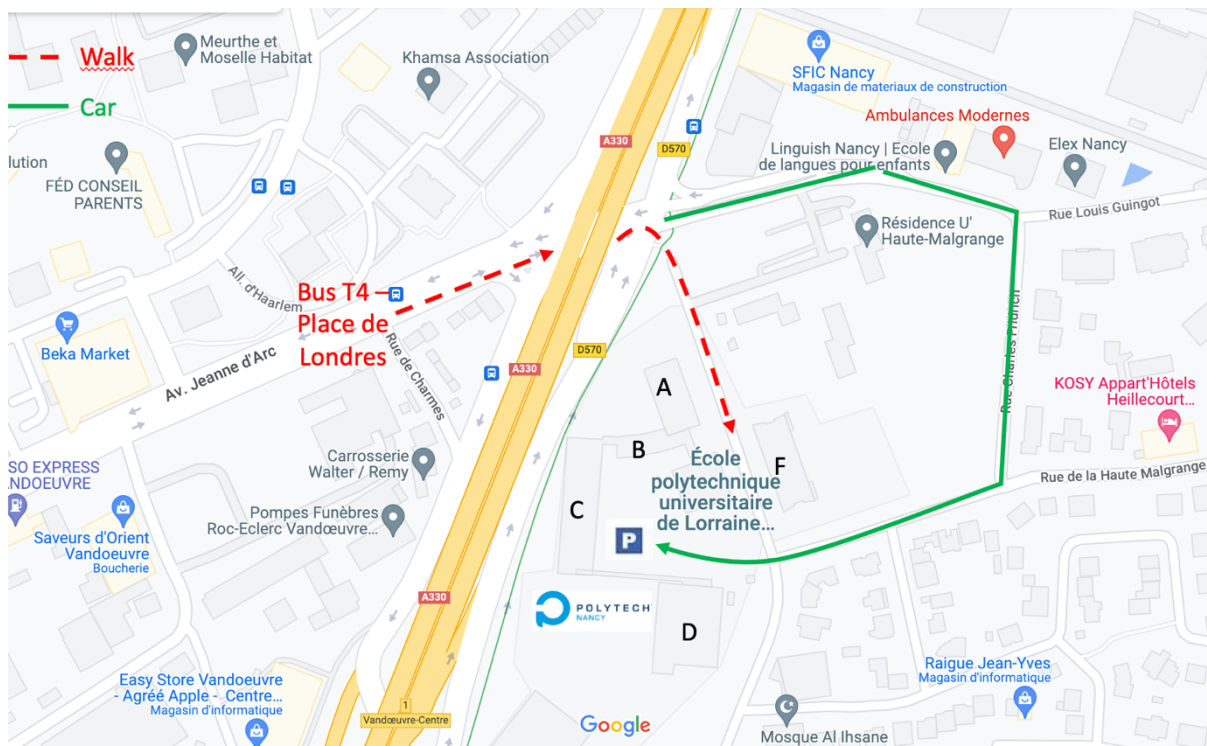
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All the attendees should wear their name badge during the Seminar!!!

Seminar Place

The Seminar venue is located at Polytech Nancy or also named Ecole Polytechnique de Lorraine (<https://polytech-nancy.univ-lorraine.fr/en>) closed to Nancy downtown by Bus ([Stan network](#)).

The **T4 bus** connects the city center (train station) to Polytech Nancy (*Place de Londres* stop located at 5 min walk T4 bus direction HOUEMONT <https://polytech-nancy.univ-lorraine.fr/fr/content/venir-polytech>) see the following map below:





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Seminar Information

Seminar Reception desk will be located at the main entrance - **open from 13h15 to 14h00 on Tuesday 15th November and from 08h00 to 08h30 on Wednesday 16th November** (see the next map below and follow outside Polytech Nancy the sign):



16th European Workshop on
 Advanced Control and Diagnosis - ACD 2022



16 – 18 November 2022, Nancy, France

