

Reusable Liquid Propellant Rocket Engine (LPRE) State of Health Estimation and Prediction for Maintenance Guidance

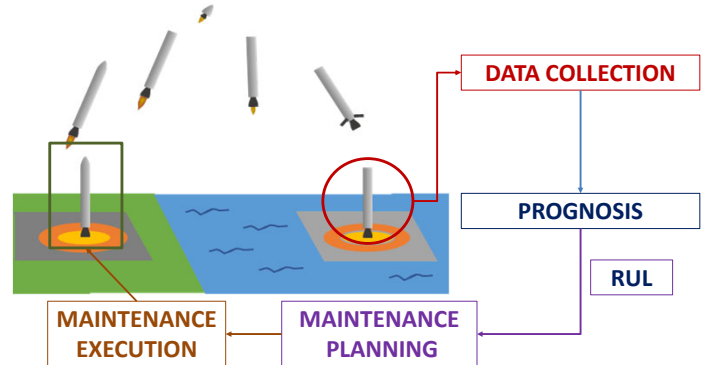
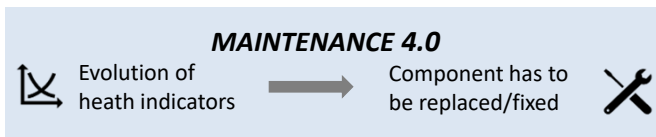
Federica GALLI

Thesis Directors : Ghaleb HOBLOS & Philippe WEBER | Supervisors : Vincent SIRCOULOMB & Giuseppe FIORE

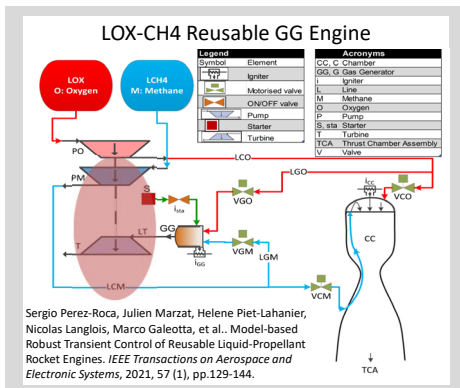
Objective: Remaining Useful Life (RUL) Prediction based on a Data-Driven Approach

Introduction and Context

Reusing a rocket engine requires maintenance on various components to ensure their proper functioning. The **high complexity** of the system imposes the need of a **tailored and optimized maintenance activity plan**, to act only when necessary.



Study Case and Methodology



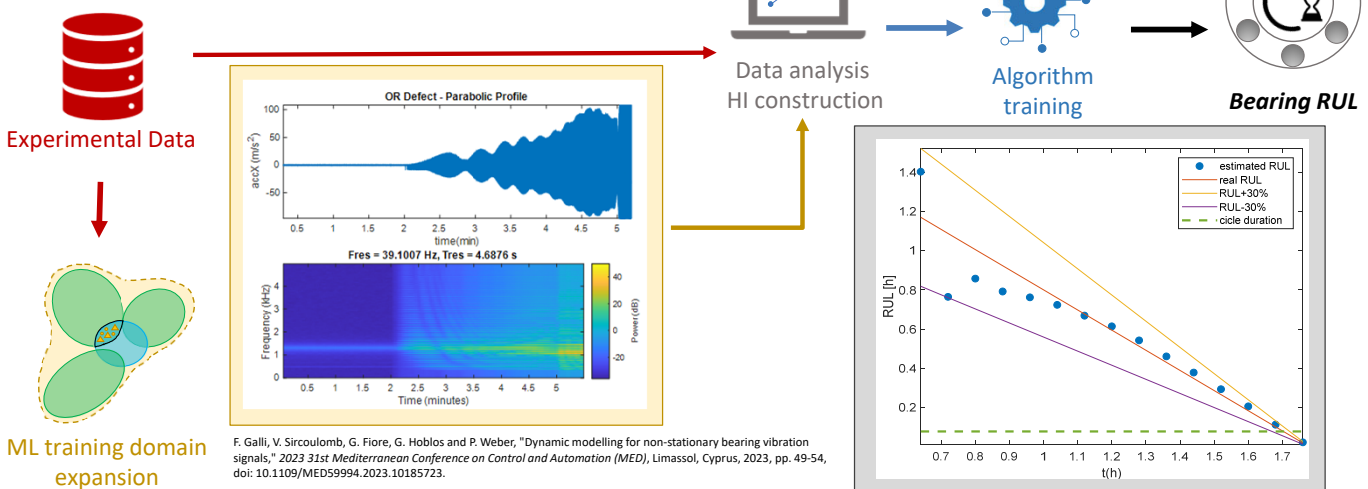
The targeted system is a Reusable Liquid Propellant Rocket Engine (LPRE)



Given the complexity of the system, it was decided to tackle the critical components one by one.

STUDY CASE: TURBOPUMP BEARING RUL ESTIMATION USING A DATA-DRIVEN APPROACH

Turbopump Bearing RUL Estimation



F. Galli, V. Sircoulomb, G. Fiore, G. Hoblos and P. Weber, "Dynamic modelling for non-stationary bearing vibration signals," 2023 31st Mediterranean Conference on Control and Automation (MED), Limassol, Cyprus, 2023, pp. 49-54, doi: 10.1109/MED59994.2023.10185723.

Galli, F., Sircoulomb, V., Hoblos, G., Weber, P., Galeotta, M. (2023). Remaining Useful Life Estimation Based on Wavelet Decomposition: Application to Bearings in Reusable Liquid Propellant Rocket Engines. In: Theilliol, D., Korbciz, J., Kacprzyk, J. (eds) Recent Developments in Model-Based and Data-Driven Methods for Advanced Control and Diagnosis. ACD 2022. Studies in Systems, Decision and Control, vol 467. Springer, Cham.

Perspectives: Cost and maintenance time reduction. Safety, reliability and availability increase.