Digital twin modeling and artificial intelligence

Topic: DIGES - DIGital twin di sistemi di ESplorazione lunare (DIGES)

TITLE: Integration of **anomalies** and **defects** in a lunar rover **Digital Twin** for performing **damage diagnosis** and **prognosis**

RESEARCH BACKGROUND:

Surface exploration of planets and satellites with rovers is the trending topic of space exploration. Rovers' complexity and costs require high reliability since anomalies or component degradation may compromise the mission. In this framework, it is possible to develop a Digital Twin (DT) of the rover to simulate its behaviour and its subsystems.

The implementation of anomalies in the DT, before the real-time operations, allows for creating a database of defects and their consequences. This can be used during the mission to perform a diagnosis of the rover, that is the identification of defects and their position and extent. The following step can be the prognosis. The latter estimates the Residual Useful Life (RUL) and the implementation of actions to address or mitigate the anomaly relying upon damage evolution collected data and physics-based damage evolution model.

RESEARCH ACTIVITIES:

1. Bibliographic analysis of state-of-art of rovers, DT and damage implementation
2. DT modelling Simulink-Simscape, damage implementation, implementation of model-updating algorithms
3. Development of a simplified scenarios to generate datasets

METHODOLOGY: Numerical – Experimental   **DURATION:** 7-9 months

CONTACTS:
francesco.cadini@polimi.it
marco.giglio@polimi.it

POSSIBLE COLLABORATIONS: ASI

POLITECNICO MILANO 1863