Data-driven monitoring of Systems-On-Chip for Multifunction Modular Cockpit Display

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Introduction:
The availability of microprocessor-based and embedded systems implies issues about their monitoring and reliability, notably in safety-critical systems. This work is part of a project to develop test benches for industrial embedded systems, where we focus on the supervision and monitoring of the SoftwareChips (ScC). We create a monitoring framework to detect faults and false alarms in the behavior of the heterogeneous SoC (CPU and GPU). Finally, we built an experimental platform and tested a set of characterization variables for the chip. Then, the model is associated with a fault detection algorithm. Estimations of the model's state inputs to the diagnostic module. The later generalizes the local presence of noise or drifts in the characteristic variables and features of SoC. The obtained results validate the proposed monitoring algorithm and demonstrate the effectiveness of the fault detection algorithm.

Objective: The Cockpit of the future:
- A user-friendly interface with touchscreens
- Displays to provide pilots with interactive instructions
- To be able to accommodate the complex functionalities of the aircraft and systems

Main lines of research:
- Incremental modeling of complex structure systems
- Characteristic with detection
- Life Cycle-Operational (LCO)
- Estimation of the remaining useful life

Online supervision through Analytical redundancy:
- A reference model is defined in parallel to the system
- The residuals from the model are compared to the outputs of the system
- Through this comparison, the model results are validated
- The diagnosis of the system is deduced by analyzing these residuals
- The residuals are also critical in diagnosis of the system

Monitoring residual evaluation:
- Comparison of the estimated state in measurement
- Law residual
- Residuals are treated by an online linear behavior model

Results and conclusion:
- The monitoring framework can be considered effective
- The fault detection algorithm helps in detecting faults in the system
- The model and the monitoring framework can be used in real-time applications

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Reference:

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