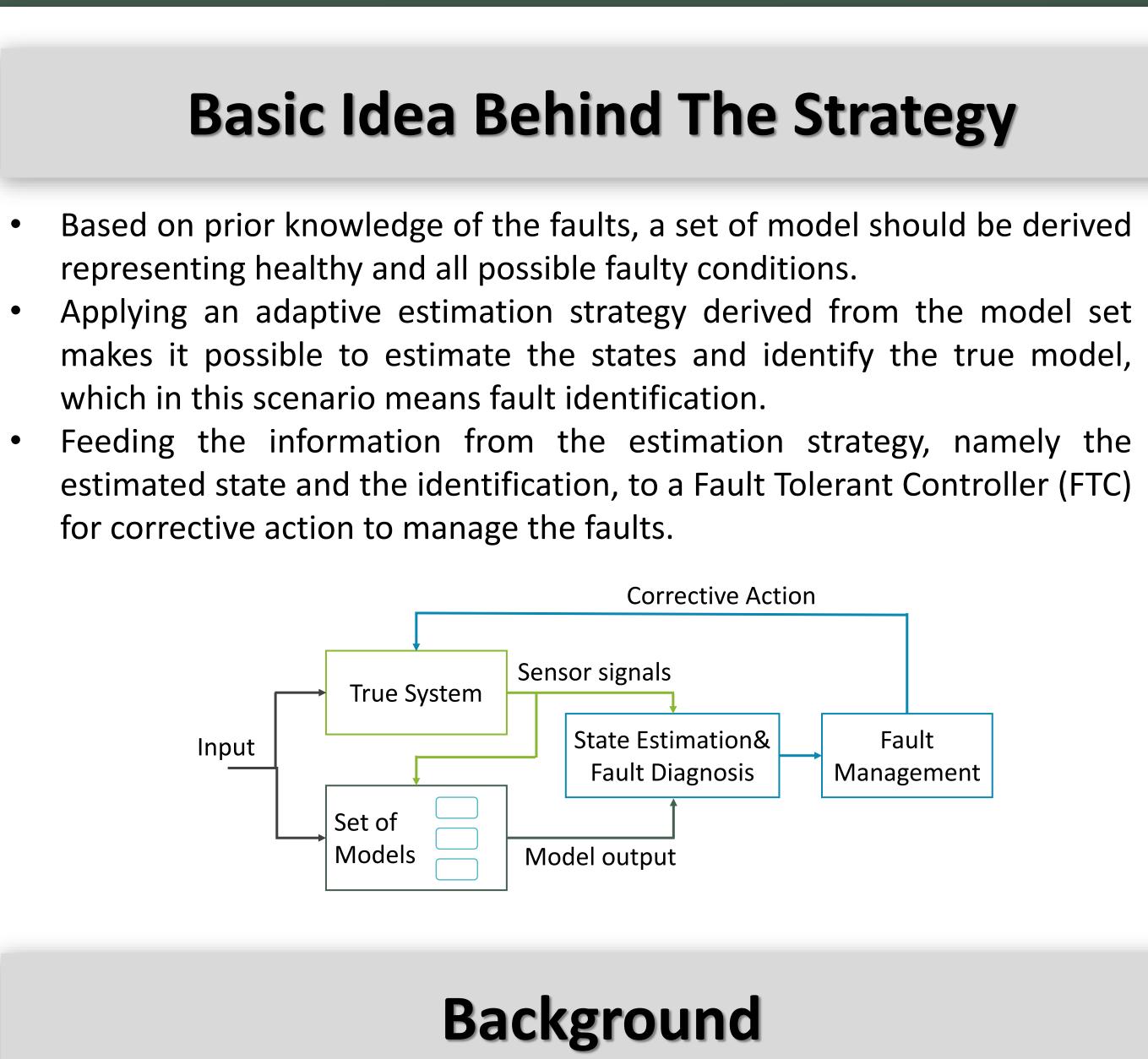
New Model-Based Fault Management Strategy Centre for Mechatronics and Hybrid Technology

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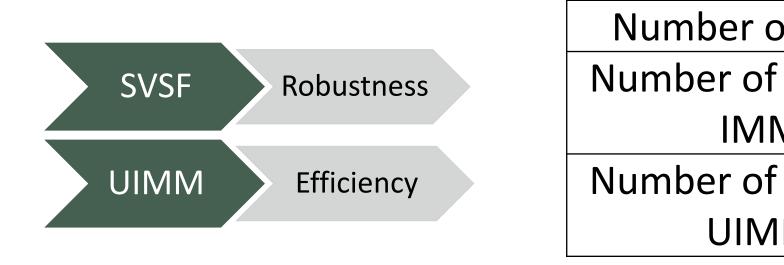
- Residual-based fault detection: This approach, which is also known as the observer-based method, compares the predicted value of the output from an observer to the measured output in order to obtain a residual error. If the residual error components exceed the predefined thresholds, faults are detected, and then, isolated through further analyses. The core element of this diagnostic system is an observer or a filter. It does not provide a proper state estimation needed for a closed-loop application.
- Joint state and parameter estimation: This approach augmented the model parameters to the state vector to be estimated online during the process. It is a nonlinear filtering problem and the optimal solution needs solving a set of nonlinear PDEs. Suboptimal solution can be achieved using well-known strategies like augmented EKF, but for large parameter uncertainty the covariance linearization of EKF becomes invalid.
- Adaptive multiple model: The main idea behind such a method is to use a finite number of models to represent different fault conditions. A finite number of filters are run in parallel based on these models. This strategy has three steps: the generation of individual state estimates matching to a given parameter vector; the evolution of the hypothesis probability; and the combination of the individual estimates.



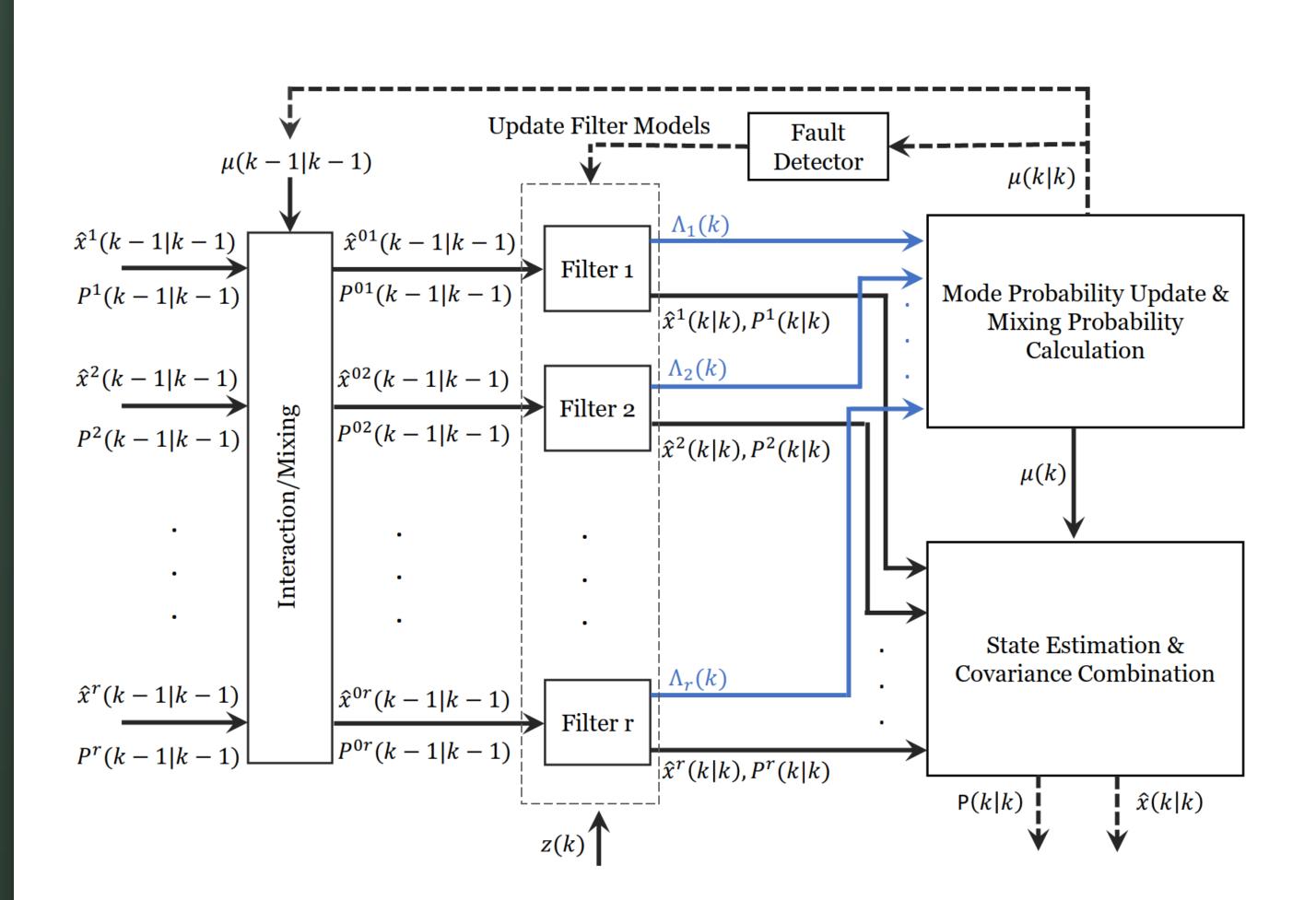


Why UIMM-SVSF-VBL?

- Interacting Multiple Model (IMM) strategy is a well-known suboptimal technique to solve the dynamic multiple model estimation problem. The proposed strategy named Updated IMM (UIMM) combined with
- SVSF-VBL filter (UIMM-SVSF-VBL).
- UIMM is a more efficient version of IMM with better performance in identifiability. It has the following property:
 - Fewer filters running in parallel
 - Higher Computational Efficiency
 - Avoiding combinatorial explosion
 - Robustness



What Is Happening In Each Loop?









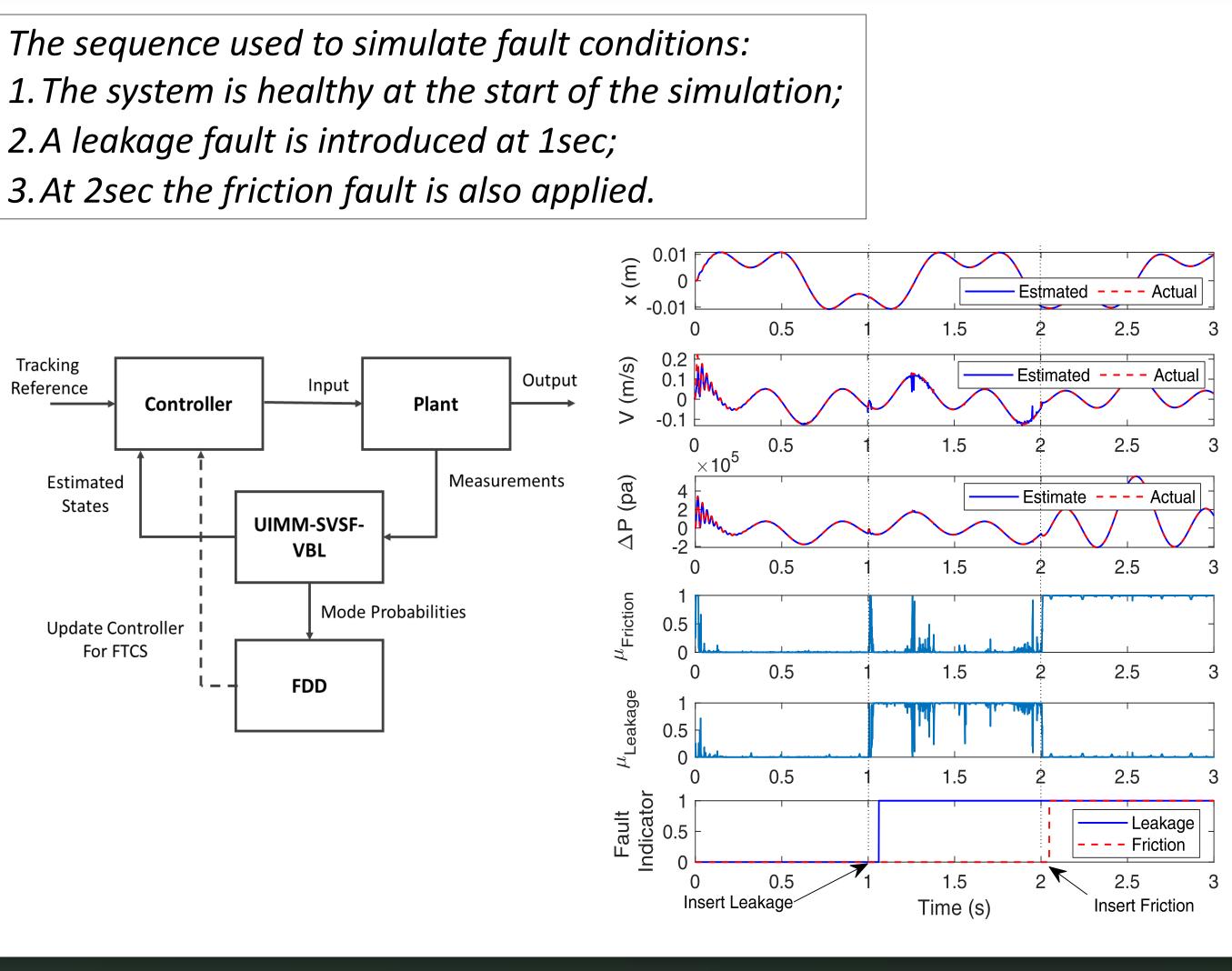
of Faults	1	2	3	4	n
f Filters in M	2	4	8	16	2 ⁿ
f Filters in 1M	2	3	4	5	n+1

Case Study: Electro-Hydraulic Actuator

Ubiquitous applications, especially in harsh environments and with strict safety requirements, make the fault management in hydraulic actuators an imperative concern for the industry. The most common faults in the EHA systems are:

• Internal and external leakage. Increasing friction due to faults in the sealing and packing of hydraulic cylinder. signals are monitored and The faults are detected and

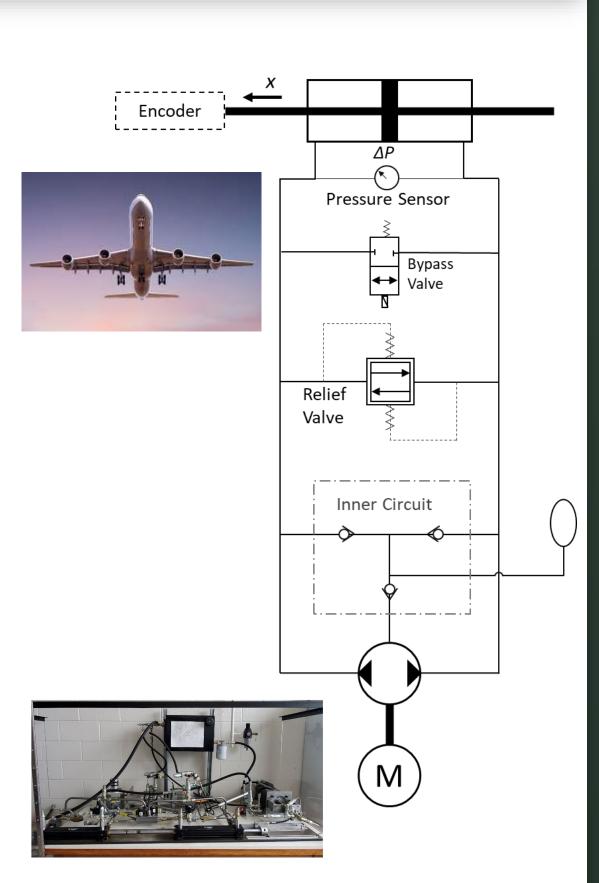
To detect and isolate these faults, the sensors compared to the outputs from the system models. isolated using the Proposed FDD strategy, then evaluated for corrective action in an adaptive FTC controller.







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Results

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