Robust supervision and diagnosis of discrete event systems

(Master thesis in Computer Science and Control)

Subject : The supervision and the diagnosis of (possibly distributed) discrete event systems is a research domain that found several applications in automatic control, and specifically for the management of telecommunication networks. Formally, this is a natural extension of classical results in formal language theory and automata theory towards problems and applications raised in the community of discrete event dynamic systems.

This internship focuses on the questions of diagnosis and state estimation, which are very well understood. The diagnosis problem can be seen as the detection of specific events in a system (typically an automaton) from the output or observations provided by this system. In the classical approach, all observations issued by the system are used to answer the question (i.e. detect the failure). Here, one is rather interested in robustifying the approach against model and observation errors. The idea is to keep only the last N observations produced by the system, and to forget about observations that are too far in the past (and that may have misguided us, or may not be relevant anymore). The problem consists in building an observer/diagnoser that corresponds to these assumptions. The starting point will be the classical derivation of observers, and one will try to transform them into sliding window observers taking into account the only last N observations. Specific attention will be paid to the relations of such objects for sizes N and N+1, and to the limiting cases for N going to infinity. One will also study the relation of this problem with the notion of local automaton.

Extensions of this work are then possible in different directions. For example to address the specific case of distributed/modular systems, or the case of stochastic systems. The links with classical methods for linear Gaussian systems could also be examined (Kalman filtering).

Bibliography :

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- "Introduction to Discrete Event Systems", C. Cassandras, S. Lafortune, Springer Ed., 1999.

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