Sensor and Actuator Fault-Tolerant Control Scheme applied to a Winding Machine

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A conventional feedback control design may result in unsatisfactory performances in the event of malfunctions in actuators, sensors or other components of the system. In high automated industrial systems where maintenance or repairing cannot be always achieved immediately, fault-tolerance has become of paramount importance. Hence, to preserve the safety of operators and the reliability of processes, the presence of faults must be taken into account during the system control design. This paper deals with the analysis and the design of the fault-tolerant control (FTC) in the presence of faults in the functioning of actuators and sensors. These faults may correspond to a certain decrease in effectiveness of the actuator, a bias or a drift on a sensor or a complete loss of these instruments. A classification of the FTC methods is proposed according to the severity of faults affecting the system. It is shown that, in the presence of a complete loss of an actuator which is a major failure, the nominal control objectives cannot be reached anymore. Thus, degraded performances are re-defined in order to avoid great failure in the system's security and productivity. The discussion of FTC is shown by its application to a winding machine. The proposed FTC method could be applied to a wider range of industrial systems.