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Administration of Faults in an Autonomous Robot Using Leaky Integrators

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Abstract
Autonomous robots are required by nature to have a large amount of reactive systems that are able to provide a time dependant response. This means the already limited resources available in autonomous robots have to accommodate a large number of time dependant decisional algorithms. Because of these limitations leaky integrators can fill the role quite well. They are lightweight in terms of computational power, easy to implement and easy to tune depending on the application. Since its discovery it has been used in electronics, mechanics and hydraulics. It has fit in particularly well in neural net models too successfully modelling a series of organic processes from neuroscience. Commonly used in reactive (bumper sensor based) navigation in autonomous robots leaky integrators can fill other roles too. In this paper we propose the use of leaky integrators as administrators of the warning flags sent by the defect detection system. In our case the defect detection system is a monitor that records and analyses the signals received from the robot sensors. A learned statistical model is used to evaluate the data (Ilian 2012) and highlight possible faults by triggering warning flags. The warning flags are then accumulated in a leaky integrator. If the trigger condition of the leaky integrator is reached it will in turn trigger a fault tree and a series of other systems to confirm and manage the fault (Ilian 2012). The implementation has proven to be robust and lightweight delivering results comparable to more complicated and computationally intensive event management systems. Favouring leaky integrators allows the redistribution of the limited computational resources of an autonomous robot to other processes that require them.

Keywords: Reliability, Faults, Robots, Autonomous Robots, Leaky Integrators.

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