DESIGN OF RELIABLE CONTROL SYSTEMS IN THE PRESENCE OF SENSOR FAULT

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ABSTRACT

IN THIS PAPER WE PROPOSE AN OBSERVER-BASED CONTROL SYSTEM TOLERATING VARIATIONS OF SENSORS. FOR EXAMPLE, SENSORS THAT DEGRADE CANNOT FUNCTION PROPERLY MAY JEOPARDIZE (CAUSE INSTABILITY) THE CONTROLLED SYSTEM. A TRADITIONAL OBSERVER, I.E., LUENBERGER OBSERVER, AS USUAL, ESTIMATES THE STATE OF THE SYSTEM IN THE PRESENCE OF SENSOR FAULT. SUCH FAULT CAUSES INCOMPLETE MEASUREMENT THAT IS NEEDED FOR THE FEEDBACK. IT'S SHOWN THAT IF A LINEAR MATRIX INEQUALITY (LMI) IS SATISFIED BY PROPERLY CHOOSING THE CONTROLLER GAIN (K) AND OBSERVER GAIN (L) , THEN THE SYSTEM CAN BE STABILIZED. USING MATLAB THE SIMULATION SHOWS THAT THE DEVELOPED OBSERVER-BASED FEEDBACK CONTROLLER IS FEASIBLE TO SYSTEM WITH SENSOR FAULT. CONSISTENCY OF SIMULATION AND EXPERIMENT RESULTS VERIFIES THAT THE DESIGNED FEEDBACK SYSTEM WORKS VERY WELL. THE POTENTIAL APPLICATIONS ARE ARRAYS OF MEMS, TACTILE SENSING OF ROBOT, EXPLORATION IN SPACE, AND BIOTECHNOLOGY.

Keywords : SENSOR, FAULT, OBSERVER, LMI, ESTIMATION

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