

# System Inversion and Actuator Fault Detection and Isolation for Linear Systems: Application to a Nuclear Reactor

Fatma Sallem, Boutaib Dahhou

LAAS-CNRS and University of  
Paul Sabatier, 7 avenue of  
Colonel Roche, F-31077. Toulouse,  
France  
fsallem@laas.fr  
dahhou@laas.fr

Zetao Li

Guizhou University  
550025, Guiyang, Guizhou, China  
gzgylzt@yahoo.com

Anas Kamoun

University of Sfax, sfax Engineering  
School, 1173 Sfax, Tunisia Research  
Laboratory on Renewable Energies and  
Electric Vehicles RELEV  
anas.kamoun@enis.rnu.tn

**Abstract**—The main contribution of this paper is a new formulation of actuator fault diagnosis for the linear dynamic system and to compare it with the conventional formulation. The proposed method is based on the representation of the actuator as a subsystem connected with the process system in cascade manner. The designed formulation is generated to obtain the conditions of the actuator fault detection and isolation. Detectability and isolability conditions are expressed in terms of the invertibility notions. An example and a comparative analysis with the classic formulation illustrate the performances of such approach for simple actuator fault detection and isolation using parameter intervals based approach.

**Index Terms**—Fault detection, fault isolation, system inversion, actuator fault, left invertibility, parameter intervals, nuclear reactor.