

Fault Detection of Gearboxes in an Industrial Robot under Various Operating Conditions

Jungho Park¹, Yunhan Kim², Jong M. Ha³, Byeng D. Youn⁴, and Jin-Gyun Park⁵

^{1,2,3,4,5}*Department of Mechanical and Aerospace Engineering, Seoul National University, Seoul, 08826, Republic of Korea*

hihijung@snu.ac.kr

gav0304@snu.ac.kr

billyhjm@snu.ac.kr

bdyoun@snu.ac.kr

⁵*Robotics Research Dep't/Robot Research Institute, Hyundai Heavy Industries, Yongin-si, Gyeonggi-do, 446-716, Republic of Korea*

wlsrbs82@hhi.co.kr

ABSTRACT

In recent years, industrial robots have been widely used for manufacturing automation. The unexpected failures of the robots could bring about a significant amount of downtime loss due to suspension of the production lines. Fault detection and diagnosis for an industrial robot become one of the backbone technologies in the Industry 4.0. However, the industrial robots operate under variable speeds and loads. This makes fault detection for the industrial robot more challenging. Moreover, signals generated from one arm joint affect those from other joints mutually due to the multiple degree-of-freedom (DOF) motions of the robots. In this paper, we develop a fault detection method for a gearbox, which is one of the most critical components of an industrial robot. Both control and acceleration signals are used for the fault detection. Health data that represent a health state of the robot system are defined as the failure mechanisms of the gears are understood. The effectiveness of the proposed health data is demonstrated using a 6-DOF industrial robot with normal and faulty cases under various operating conditions in terms of rotating speed, rotating directions, number of DOF, different postures of robot arms, and loading condition.