COMPARISON BETWEEN THE ONE PIEZOELECTRIC ACTUATOR AND THE TWO ONES ON VIBRATION CONTROL OF A FLEXIBLE TWO-LINK MANIPULATOR USING FINITE ELEMENT METHOD

ABDUL KADIR MUHAMMAD[1], SHINGO OKAMOTO[2] & JAE HOON LEE[3]

[1]Center for Mechatronics and Control Systems, Mechanical Engineering Department,

State Polytechnic of Ujung Pandang, Jalan Perintis Kemerdekaan KM 10, Makassar, Indonesia

[2,3,4]Graduate School of Science and Engineering, Ehime University, 3-Bunkyo-cho, Matsuyama, Japan

ABSTRACT

The purposes of this research are to derive the equations of motion of a flexible two-link system by a finite element method, to develop computational codes in order to perform dynamics simulations with vibration control and to propose an effective control scheme of a flexible two-link manipulator. The flexible two-link manipulator used in this paper consists of two aluminum beams as flexible links, two clamp-parts, two servo motors to rotate the links and two piezoelectric actuators to control vibration. Computational codes on time history responses, FFT (Fast Fourier Transform) processing and eigenvalues - eigenvectors analysis were developed to calculate the dynamic behavior of the links. Furthermore, a control scheme using the piezoelectric actuators was designed to suppress the vibration. Two proportional-derivative controllers were designed and demonstrated their performances. The calculated results of the controlled two-link manipulator revealed that the vibration of the flexible manipulator can be controlled effectively even though only use one piezoelectric actuator.

KEYWORDS: Finite Element Method, Flexible Manipulator, Piezoelectric Actuator, Vibration Control