

진행파 여진에 의한 굴곡 신축진동을 이용하는 압전 펌프

A piezoelectric pump using extensional vibration of lateral surface by traveling wave

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Abstract : In this paper, we propose a novel type valveless micro-pump that uses extensional vibration mode of traveling wave as a volume transporting means for solving some problems about check valves, essential parts of usual pumps. The proposed pump consists of two piezoelectric ceramic rings and a metal body located in the middle of them respectively. Because the drift of bended surface that results from the traveling wave excitation controls the fluid flow, check valves are not needed in this pump model. In accordance with the variation of the pump body dimension, we analyzed the vibration displacement characteristics of pump model, determined the optimal design condition, fabricated the prototype pump from the analysis results and evaluated its efficiency.

Key Words : Piezoelectric pump, Traveling wave, Valveless type, Finite element method

1. 서 론

Micro-pumps have the special characteristics to be able to transport minute and accurate amount of liquid or gas. Hence, micro-pumps are fit to serve the chemical and biological substance analyzing system as micro-fluid flow control appliances[1]. These devices generally consist of a chamber (or chambers) to be created by the deformation of actuator and check valves to manage the fluid flow. But check valves installed in micro pump raise some problems like pumping performance degradation by abrasion, fatigue and valve blocking, etc.[2]. In order to solve the critical problems, extensive research and development on valveless type pump have been conducted.

2. 결과 및 토의

In this paper, we propose a novel type valveless micro-pump that uses extensional vibration mode due to traveling wave excitation as a volume transporting means. The proposed pump is consisted of ring type of piezoelectric ceramics and metal body. The main feature of this pump is not required the check valves because the peristaltic action produces to the tightly closed space that can be played an important role as a squeezing effect. And, as the input power is turned off, the sliding interface formed between coaxial shells against each other stops the flow of fluid. Therefore, self-locking action is automatically produced like a closing operation of the conventional check valves. Furthermore, vibration displacement enlargement at the bending surface can be expected by two piezoelectric ceramic rings installed like sandwich shape. To verify the operation principle of the pump model, a numerical simulation analysis was conducted using FEM software. Modal and harmonic analyses were carried out for its suitable design. Based on the simulation results, we made a prototype micro-pump and tested its performance.

감사의 글

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참고 문헌

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