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Abstract
This thesis describes a study concerning diffuser and peristaltic micropumps simulation and analysis using Ansys and fluid-electric analogy theory. The purpose of this research is for micropumps optimum designing as well as understanding the operating behaviors of micropumps system which is supposed to be complicated and difficult to understand due to its micro scale dimension. In our simulation and analysis process, we considered the equivalent system more completely than other researches which mostly have not considered the effects of inlet-outlet pipes to the hydraulic system and their research just limited to the diffuser micropumps.
This study evaluated many kinds of micropumps performance such as flow rate versus operating frequency, system inertia effects, flow rate of different liquids, flow rate versus backpressure, flow rate versus actuation pressure, flow rate versus pressure drop through diffuser valves, the pressure behavior at different points inside the system and actuator membrane displacement as well with the support of AnsysU+D2 8.1, CircuitMakeU+D2 6.2 Pro, OriginU+D2 7.0 SR0. Especially we proved the downhill phenomenon in the flow rate – operating frequency relation is due to the system inertance which has been supposed by some previous researchers but has not been proved by experiment or simulation. The simulation and experiment results are quite agreed supposes that the built-up equivalent circuit and analysis method are good enough and can be applied.
Actuator-membrane modal analysis was investigated to check if the structure natural frequency is equal to frequency at which the system performs maximum flow rate and the analysis results indicated that the modal frequency is different from flow rate frequency.
Theory concepts were proposed to explain theoretically the down-hill phenomenon of flow rate. These concepts were verified by experiment results and numerical analysis.
Actuator-membrane optimum design was executed to define the optimum geometry for pump

actuator. The optimum definition method was proposed and applied.
Advisory Committee Yi-Chu Hsu - advisor

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