Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Analysis of flow characteristics for viscosity sensing applications of suspended microchannel resonators WOOK LEE, JUNGCHUL LEE, SEONGWON KANG, Dept. of Mechanical Engineering, Sogang University, Korea — In this study, we analyzed the flow characteristics and performance of a viscosity sensor based on a suspended microchannel resonator (SMR). First, we verified the assumptions of Sader et al. (2010) for their analytic solution using the approach of direction numerical simulation. Second, the relationship between monotonicity of the quality factor and the changes of integrated energy variables was investigated. It was found that the monotonicity to the Reynolds number is strongly dependent on a source term of the kinetic energy equation. Based on this, a change in the quality factor was related to specific patterns of the velocity and vorticity fields. Third, the effects of geometrical parameters of the SMR on performance as a viscosity sensor were investigated. The variations in the measurable viscosity range as well as the viscosity resolution were investigated in terms of the flow characteristics affected by the design parameters. It was found that the off-axis displacement shows a significant but consistent effect on performance of the SMR viscometer regardless of the flow condition. In contrast, the other geometric parameters show more complicated effects, as they are also related to the resonant frequency of the SMR and affected by the compressibility of a fluid.

Wook Lee
Dept. of Mechanical Engineering, Sogang University, Korea

Date submitted: 31 Jul 2013 Electronic form version 1.4