Abstract No. 00

Arrays of biomimetic hair flow-sensor dedicated for measuring flow patterns

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Flow sensor arrays can be used to extract features from flow fields providing local measurements, rather than averaged signals, provided the sensors in the array structure can be interrogated individually. This paper addresses the latest developments in fabrication and array interfacing of biomimetic artificial air-flow sensors. Hair flow sensors in wafer-scale arrays have been successfully fabricated using SOI wafers with deep trench isolation structures. The current fabrication process differs from the previous process [1] in a redesign of the sensor electrodes enabling wafer-level array fabrication and individual array element interfacing.

Using Frequency Division Multiplexing (FDM) technique, we were able to simultaneously measure flow signals at multiple sensor positions. To employ FDM a bank of oscillators is used to feed different carrier signals to array columns. The amplitude modulated (AM) signals are collected per row of the array and fed into a single charge amplifier and further to synchronous demodulator to eventually extract the actual flow-velocity signals. Reconstruction of the flow fields by the array, while employing FDM, is demonstrated by localizing position of the sphere along the array using beamforming techniques. The results show a successful imaging of the sphere as detected by different hairs along the array while using array signal processing (i.e. Beamforming) techniques. The estimated separation distances between the hairs perfectly matches the measured distance. This verifies the capability of artificial hair arrays in imaging flow patterns.

With virtue of array signal processing techniques and FDM, once signals are retrieved from all individual array hairs, spatio-temporal flow patterns can be reconstructed while few system interconnects are required. This adds new dimensions to 3D imaging of the surrounding environment.

References

[1] C. Bruinink et al., Proc. MEMS 2009, pp. 152-155.