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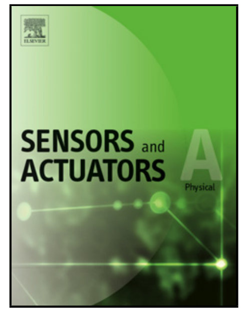

Title: Fibre-optic sensing in digital microfluidic devices

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Fibre-optic sensing in digital microfluidic devices

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Highlights

- • A fibre-optic sensing architecture for digital microfluidic devices is introduced and developed.
- • Multiple microdroplets can be sensed along row and column fibre-optic cables.
- • The fibre-optic sensing architecture is shown to be scalable through model and experimental results.

Abstract–This work introduces a fibre-optic sensing architecture for digital microfluidic devices. The fibre-optic sensing architecture relies on a change in the total internal reflection angle to detect the presence of microdroplets in contact with the fibre-optic cables through lowered optical transmission. The architecture uses *m* parallel column fibre-optic cables orthogonally overlapped with *n* parallel row fibre-optic cables to provide the Cartesian coordinates of multiple microdroplets. This creates $m \times n$ microdroplet sensing positions, for high localization, with only $m + n$ measurement points, for practical implementation. The contact times of advancing and receding microdroplets are measured using an experimental configuration of the architecture. These contact times are found to be within the acceptable time limitations for high-speed operation of the digital microfluidic device. Ultimately, the fibre-optic sensing architecture is experimentally demonstrated as a three by three architecture for the localization of multiple microdroplets.

Abstract

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Keywords: Digital microfluidics; electrowetting-on-a-dielectric; on-chip sensing; lab-on-a-chip devices; microelectromechanical systems