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Coherent structures of electrokinetic instability in microflows KAUSHLENDRA DUBEY, AMIT GUPTA, SUPREET SINGH BAHGA, Indian Inst of Tech-New Delhi — Electrokinetic instabilities occur in fluid flow where gradients in electrical properties of fluids, such as conductivity and permittivity, lead to a destabilizing body force. We present an experimental investigation of electrokinetic instability (EKI) in a microchannel flow with orthogonal conductivity gradient and electric field, using time-resolved visualization of a passive fluorescent scalar. This particular EKI has applications in rapid mixing at low Reynolds number in microchannels. Previous studies have shown that such EKI can be characterized by the electric Rayleigh number (Ra_e) which is the ratio of diffusive and electroviscous time scales. However, these studies were limited to temporal power spectra and time-delay phase maps of fluorescence data at a single spatial location. In the current work, we use dynamic mode decomposition (DMD) of time-resolved snapshots of EKI to investigate the spatio-temporal coherent structures of EKI for a wide range of Ra_e. Our analysis yields spatial variation of modes in EKI along with their corresponding temporal frequencies. We show that EK instability with orthogonal conductivity-gradient and electric field can be characterized by transverse and longitudinal coherent structures which depend strongly on Ra_e.

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