

Abstract Submitted
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Flow-field characterization over 1D and 2D periodic wavy walls using PIV in a refractive-index-matched channel LEONARDO P. CHAMORRO, A.M. HAMED, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Chamapign, CARLO ZUNIGA ZAMALLOA, University of Illinois at Urbana-Chamapign — Flow over two wavy walls was experimentally investigated using high- and low-frame-rate particle image velocimetry (PIV). The first wall has 1D streamwise waves with amplitude-to-wavelength ratio $a/\lambda = 0.05$. The second wall has streamwise and spanwise waves with $a/\lambda = 0.05$ and 0.025 , respectively. A refractive-index matching approach was used to minimize image distortion and reflections. It grants unobstructed optical access and allows for very near-wall velocity measurements. Flow-field measurements were acquired at multiple streamwise-wall-normal and wall-parallel planes. The low-frame-rate measurements were used to obtain high-resolution ensemble-averaged flow fields and turbulence statistics, while the high-frame-rate measurements were used to map the structure of the turbulence at various wall-normal locations and to determine scale-dependent correlations across the topological features of the walls. The results were studied to understand the link between the turbulence structure and wall undulations. Linking the turbulence to wall topology has many implications in environmental flows, sediment transport and advection diffusion of scalars.

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