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Patterns of 3D flow in a rotating cylinder array ANNA CRAIG, JOHN DABIRI, JEFFREY KOSEFF, Stanford University — Experimental data are presented for large arrays of rotating, finite-height cylinders, which show that the three-dimensional flows are strongly dependent on the geometric and rotational configurations of the array. Two geometric configurations of the cylinders, each with two rotational configurations, were examined for a total of four arrays. 2D PIV was conducted in multiple intersecting horizontal and vertical sheets at a location far downstream of the leading edge of the array in order to build up a picture of the 3D developed flow patterns. It was found that the rotation of the cylinders drives the formation of streamwise and transverse flow patterns between cylinders. These horizontal flow patterns, by conservation of mass, drive vertical flows through the top of the array. As the array of rotating cylinders may provide insight into the flow kinematics of an array of vertical axis wind turbines, this planform flux is of particular interest as it would bring down into the array high kinetic energy fluid from above the array, thus increasing the energy resource available to turbines far downstream of the leading edge of the array.

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