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Harvesting energy from turbulence in boundary layers by using piezoelectric generators YIANNIS ANDREOPOULOS, DOGUS H. AKAYDIN, NIELL ELVIN, City College of New York, Mechanical Engineering — The availability of significant kinetic energy in fluid flows distributed over a number of temporal and spatial scales creates a unique opportunity to convert this energy into electrical output by using piezoelectric generators. The unsteadiness due to turbulence can produce mechanical strain energy in the piezoelectric material which in turn can generate a build up of charge that can be used to power electronic devices. In the present work, short length piezoelectric beams were placed in a zero pressure gradient two dimensional turbulent boundary layer at Reynolds numbers based on momentum thickness up to 6500 to evaluate their performance as energy generators. The piezoelectric beam was traversed across the boundary layer to determine the location where the output power is maximized. It was found that the location of maximum power is not close to the wall where most of the turbulent activities are high but further away from the wall. The work has shown that there is a three-way coupled interaction between the fluid flow, the piezoelectric structure and its electromechanical field.

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