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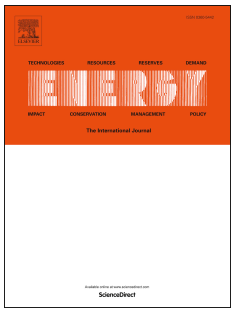

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Anan Garzozi, David Greenblatt

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A Pulsed Coandă-Effect Reciprocating Wind Energy Generator

Anan Garzozi*, David Greenblatt

Faculty of Mechanical Engineering, Technion - Israel Institute of Technology, Technion City, Haifa, 3200003, Israel

Abstract

A radically new concept in small-scale wind-energy generation is presented that produces reciprocating motion of a bluff-body by periodically activating boundary layer control via blowing slots. The reciprocating motion is best suited to directly perform mechanical work, such as the pumping of liquids. A proof-of-concept scale-model technology demonstrator was constructed and tested. It consisted of a vertically-mounted circular cylinder, connected to a pivot at its lower end. The cylinder was counterbalanced by tension springs and useful mechanical loading was simulated by means of a calibrated electromagnetic brake. The cylinder included two diametrically disposed span-wise blowing slots that were pulsed alternately to produce bi-directional transverse loads (lift) made possible by the Coandă effect. Measurements included the static loads generated by the Coandă effect and system power performance evaluations. The former were used, together with a theoretical linear model, for performance predictions. Direct system performance measurements demonstrated a positive net power output, while model predictions indicated efficiencies of approximately 20%. Although the performance in terms of system efficiency, at this stage, is inferior to that of small wind turbines, several improvements were proposed in order to render the concept more energetically competitive.

Keywords: Wind energy, Coandă effect, Reciprocating motion, Active flow-control, Oscillating wind energy generation systems

*Corresponding author.

Email addresses: anang.210@gmail.com (Anan Garzozi), davidg@technion.ac.il (David Greenblatt)