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Regulars



Outer space: Blowin' in the wind

by John D. Barrow



Finding the maximal efficiency

We want to calculate the maximum value of windmill efficiency P/P_0 . Write y for P/P_0 and x for V/U . We get

$$y = \frac{1}{2}(1 - x^2)(1 + x).$$

Differentiating we get

$$dy/dx = \frac{1}{2}(1 - 2x - 3x^2).$$

The maximum occurs when $dy/dx = 0$, in other words when

$$3x^2 + 2x - 1 = 0.$$

This happens for $x_0 = 1/3$ and $x_1 = -1$. Discounting the negative solution we get a maximal efficiency of

$$1/2(1 - x_0^2)(1 + x_0) = 16/27.$$

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