

Affordable Aerodynamic Balance for Instrumentation in a Wind Tunnel Using Arduino

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Abstract : The teaching of fluid mechanics in engineering courses is, in general, a source of great difficulties for learning. The possibility of the use of experiments with didactic wind tunnels can facilitate the education of future professionals. The objective of this proposal is the development of a low-cost aerodynamic balance to be used in a didactic wind tunnel. The set is comprised of an Arduino microcontroller, programmed by an open source software, linked to load cells built by students from another project. The didactic wind tunnel is 5,0m long and the test area is 90,0 cm x 90,0 cm x 150,0 cm. The Weq® electric motor, model W-22 of 9,2 HP, moves a fan with nine blades, each blade 32,0 cm long. The Weq® frequency inverter, model WEGCFW 08 (Vector Inverter) is responsible for wind speed control and also for the motor inversion of the rotational direction. A flat-convex profile prototype of airfoil was tested by measuring the drag and lift forces for certain attack angles; the air flux conditions remained constant, monitored by a Pitot tube connected to a EXTECH® Instruments digital pressure differential manometer Model HD755. The results indicate a good agreement with the theory. The choice of all of the components of this proposal resulted in a low-cost product providing a high level of specific knowledge of mechanics of fluids, which may be a good alternative to teaching in countries with scarce educational resources. The system also allows the expansion to measure other parameters like fluid velocity, temperature, pressure as well as the possibility of automation of other functions.

Keywords : aerodynamic balance, wind tunnel, strain gauge, load cell, Arduino, low-cost education

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