

Integrated sensor platform for complete air and inertial data set definition

Abstract

The smart air-data attitude heading reference system is able to provide complete sets of air and inertial data, such as speed, altitude and aerodynamic angles. The distinguishing feature of the proposed invention is the method used for computing incidence and sideslip angles. Unlike conventional systems, which employ a dedicated sensor for each measurement, the presented device estimates them indirectly with soft-computing techniques.



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mems

incidence and sideslip angles

air data

soft-computing

inertial and pressure transducers

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Description

The smart air-data attitude heading reference system comprises a standard microcontroller, off-the-shelf inertial and pressure MEMS sensors, a GPS signal receiver, a magnetometer, an inclinometer that calculates the attitude angles with great accuracy - conventional devices entail a higher error of approximately two degrees in non-stationary conditions - and by embedded software, which estimates aerodynamic angles in an indirect way based on soft-computing techniques.

Applications

A complete air and inertial data set is an indispensable tool for any aircraft equipped with automatic driving and control systems. Although the presented invention is usable by all airplanes, unmanned aerial vehicles are the ideal target market because the built-in sensor would allow for redundancy and increased safety. In fact, since the constraints of certification are less stringent for this aircraft category, their implementation would be possible in a shorter time frame.



Advantages

The innovation with respect to currently available devices is that the proposed system requires a smaller number of external sensors for the calculation of complete air and inertial data set, reducing the weight of the device, non-recurring costs, maintenance, dimensions of the aircraft and the issues associated with the installation of transducers into the fuselage. The latter is a particularly important problem on modern UAVs because of the interference with electro-optical sensors. In addition, the electric power consumption for

anti-freeze devices is reduced, increasing the safety of these systems due to both absence of scrolling mechanical parts and independence from environmental conditions. In this way the redundant architecture is considerably simplified and aircraft weight, size and cost are reduced. The global UAV market has the highest business potential and considerable potential for growth over the next five years. This expected development will sustain the demand for attitude heading reference systems.