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Aircraft Automatic Collision Avoidance Using Spiral Geometric Approach

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Abstract : This paper provides a description of a Collision Avoidance algorithm that has been developed starting from the mathematical modeling of the flight of insects, in terms of spirals and conchospirals geometric paths. It is able to calculate a proper avoidance manoeuver aimed to prevent the infringement of a predefined distance threshold between ownship and the considered intruder, while minimizing the ownship trajectory deviation from the original path and in compliance with the aircraft performance limitations and dynamic constraints. The algorithm is designed in order to be suitable for real-time applications, so that it can be considered for the implementation in the most recent airborne automatic collision avoidance systems using the traffic data received through an ADS-B IN device. The presented approach is able to take into account the rules-of-the-air, due to the possibility to select, through specifically designed decision making logic based on the consideration of the encounter geometry, the direction of the calculated collision avoidance manoeuver that allows complying with the rules-of-the-air, as for instance the fundamental right of way rule. In the paper, the proposed collision avoidance algorithm is presented and its preliminary design and software implementation is described. The applicability of this method has been proved through preliminary simulation tests performed in a 2D environment considering single intruder encounter geometries, as reported and discussed in the paper.

Keywords : ADS-B Based Application, Collision Avoidance, RPAS, Spiral Geometry.
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