航機軌跡預測與衝突分析

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中文摘要

　　空域內飛航安全與航機間是否存在可能衝突息息相關，如能事先透過航機之軌跡預測即可判斷航機未來在空域中可能位置，此等資訊即可作為評估航機是否可能發生衝突之依據。經由衝突分析結果，可及早採取因應對策，以避免衝突，確保台北飛航情報區內航機之安全，亦可作為未來終端管制區空域調整項目或評量管制員工作負荷之參考。

　　本研究以航機雷達資料與管制條資料篩選出欲分析之 FB1 離場航機資料，進行航機平面軌跡、垂直軌跡與地速等分析工作。應用初始航機水平累積距離與地速資料之關係結合運動方程式預測下一時點之水平累積距離；預測之水平累積距離與航機計劃之前進方向即可求得平面預測座標；透過水平累積距離與爬升斜率之關係求得預測高度；至於到場程序之航機航管介入明顯，無法分析與預測到場航機軌跡，故本研究假設到場航機以 BADA 產生之數據航行於到場程序航路，以進行航機可能衝突之分析，結果顯示，現行的航路設計，若無航管介入，離場航機與到場航機之間是有可能發生衝突。

關鍵詞：航機軌跡預測、航機衝突

Flight Trajectory Prediction and Conflict Analysis

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Abstract

Flight safety in airspace is closely related to the potential aircraft conflicts. If the flight trajectory can be predicted in advance, possible future flight positions will be known, which could be the basis of evaluation of flight conflicts. With the conflict analysis, corresponding measures may be taken in the early stage to prevent conflicts. Thus, the flight safety in Taipei Terminal Control Area is ensured. The results could also be the references for adjusting the structure of terminal control area and for evaluating the workload of the controllers.

This thesis, using flight radar data and flight strips, analyzes horizontal and vertical flight trajectories and ground speed of aircrafts following FB1 Departure. Applying the correlation between the accumulated horizontal distance of the flights and the ground speed as well as the motion formula, the prediction of next accumulated horizontal distance is obtained. The horizontal coordinates can be predicted through the predicted accumulated horizontal distance and the planned flying direction. The height is forecasted from the predicted accumulated distance and the climb rate. Because controllers intervene in the arrival flights, the arrival flight trajectory cannot be successfully analyzed and predicted. Therefore, the thesis assumes that the arrival flights follow the arrival route with BADA data for the conflict analysis. The result confirms that without the controllers' intervention, conflicts can occur between take-off flights and arrival flights in the present route design.

Key words: Flight Trajectory Prediction, Flight Conflict