NATIONAL INSTITUTE OF AEROSPACE

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Guide to APA-Based Models

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Guide to APA-Based Models

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In Robins and Delisi (2008), a linear decay model, a new IGE model by Sarpkaya (2006), and a series of APA-Based models were scored using data from three airports. This report is a guide to the APA-based models.

A list of models used in Robins and Delisi (2008), as presented in Section 3, is as follows:

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>APA 3.1.1</td>
<td>- the original APA model with a minimum circulation decay in ground effect of ( \Gamma/\Gamma_o = 1 - T/K ), ( K=8 ), and a modified version of APA 3.1.1 with ( K=5 ).</td>
</tr>
<tr>
<td>APA 3.2.1</td>
<td>- APA 3.1.1 with Proctor’s model for the circulation decay during the initial stages of IGE; with the same minimum decay rates as in APA 3.1.1. Proctor’s model is linearly phased in between the times of ( 0.25T ) and ( 0.4T ), where ( T ) is the time scale ( b_o/V_o ), ( b_o ) and ( V_o ) being the initial separation and descent speed of the vortices.</td>
</tr>
<tr>
<td>APA 3.2.1E</td>
<td>- APA 3.2.1 with a minimum decay rate equal to the environmental decay rate at the beginning of IGE or ( \Gamma/\Gamma_o = 1 - T/K ), ( K=8 ), if the environmental rate is less than this; also scored was a version of APA 3.2.1E with ( K=5 ).</td>
</tr>
<tr>
<td>APA 3.2.2</td>
<td>- An alternate version of APA 3.2.1 (( K=5 ) only) where the onset of Proctor’s model occurs exactly at a time of ( 0.25T ).</td>
</tr>
<tr>
<td>APA 3.2.2E</td>
<td>- An alternate version of APA 3.2.1E (( K=5 ) and ( 6 )) where the onset of Proctor’s model occurs exactly at a time of ( 0.25T ).</td>
</tr>
<tr>
<td>Sarpkaya’s IGE Model</td>
<td>- described by T. Sarpkaya in a report entitled “A Physics-based Real-time IGE Model of Aircraft Wake Vortices Subjected to Crosswind and Stratification.”</td>
</tr>
<tr>
<td>1 – T/5 Linear Decay</td>
<td>- APA 3.1.1 with the IGE non-dimensional decay rate equal to ( 1 - T/5 ).</td>
</tr>
</tbody>
</table>

The source codes for models APA 3.1.1, APA 3.2.1, APA 3.2.1E, APA 3.2.2, APA 3.2.2E, and Sarpkaya’s IGE Model are provided on an accompanying CD-ROM disk. The one-line code change that determines the value of \( K \) for the APA 3.X.X models is clearly indicated in the code for the respective models. To find this code,
simply search for “C**********” in files ge1pth.f and ge2pth.f to find the code that sets K.

The code change required to transform APA 3.1.1 to the 1 – T/5 Linear Decay model is as follows:

Original Code from APA 3.1.1 files ge1pth.f and ge2pth.f:

```
C
C******************* FOLLOWING CODE FOR K=8 ***********************
DGMIN = 0.125*TWOPI*VZIN*VZIN
C******************* FOLLOWING CODE FOR K=5 ***********************
CCC           DGMIN = 0.2*TWOPI*VZIN*VZIN
C****************************************************************
C
IF(DELGAM.LT.DGMIN) DELGAM=DGMIN
C
DGFAC = DELGAM/GAM(1)
DO I=1,NPTS
   DGAM(I) = GAM(I) * DGFAC
ENDDO
C
```

Modified Code for the 1 – T/5 Linear Decay Model:

```
C
DELGAM = 0.2*TWOPI*VZIN*VZIN
C
DGFAC = DELGAM/GAM(1)
DO I=1,NPTS
   DGAM(I) = GAM(I) * DGFAC
ENDDO
C
```

The input parameters required for all code versions are the same as described for LINES 3-10 in Robins and Delisi, 2005.
References

