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What's New in AAA?

Version 2.4

November 2002

DARcorporation is proud to announce the release of **Advanced Aircraft Analysis (AAA), Version 2.4**. Those of you already familiar with the versatility and clarity of AAA 2.3 will be even more pleased with the introduction of Version 2.4. New features and submodules will become quite evident to AAA users accustomed to Version 2.3 while dozens of improvements and modifications heighten the program's efficiency and precision.

Through customer feedback, AAA users have supplied ideas for new features. Some requests involve entirely new analysis modules while others seek the extension of existing ideas. All of these new features are described in Parts II and III of the User's Manual.

Section 1 shows the enhancements and modifications made to AAA. Major enhancements are new modules and new calculations. The second section contains bug fixes. Many of these bug fixes deal with extreme cases such as division by zero or square roots of negative numbers when non-conventional configurations are designed.

1. Enhancements and Modifications

A module-by-module overview of the differences between AAA 2.3 and AAA 2.4 is listed below.

1.1   Weight

1. Tip-over angle has been moved to Geometry
2. Center of Gravity is added to calculate current, forward and aft center of gravity relative to the wing M.G.C.

1.2   Aerodynamics

1. Class II Drag Plotting: error messages do not show up if a component is not selected
2. Trend line in Class II Drag has a plotting option
3. Zero Lift Pitching moment and zero-angle-of-attack lift coefficient modules for all lifting surfaces and complete airplane are added
4. Trim points are added to Class II drag polar plot.
5. Effects of control surface gaps on drag are added in Class II drag.
6. Trimmed lift has been added.
7. Lifting Line: calculation of aerodynamic twist as function of geometric twist, root airfoil zero-lift angle of attack and tip airfoil zero-lift angle of attack has been added.
8. Zero-lift angle of attack is calculated from root and tip airfoil characteristics. In previous versions a constant airfoil section was assumed. When loading a pre 2.4 file, AAA will ask whether the root and tip airfoil have the same zero-lift angle of attack.
9. Plotting of ground effect parameters as function of angle of attack and height above the ground is added.
10. Plotting of power effect parameters as function of angle of attack is added.
11. Drag power factor is added to power effects.
12. Aerodynamic center shift due to fuselage, nacelles, stores, tailbooms and floats is moved from Stability and Control to Aerodynamics.
13. Aerodynamic center shift due to fuselage, nacelles, stores, tailbooms and floats the factor 0.08 is replaced with 0.0785 to correct downwash gradients (see help in AAA).
14. Dynamic pressure ratio is moved from Stability and Control to Aerodynamics
15. More parameters are added to the output of power effects to show how different terms are build-up.
16. Dynamic pressure ratio on the horizontal tail is now an output in power effects and ground effects.
17. Dynamic pressure ratio on the horizontal tail can be plotted as function of angle of attack.
18. Nacelle and Pylon lift are added
19. Effect of flaps on downwash gradient is added.

20. Effect of forward sweep on aerodynamic center is added.
21. Transonic methods for lifting surface lift curve slope are added.
22. Effect of body width on lift curve slope is added.

1.3   Performance

No Changes

1.4   Geometry

1. Tip-over angle is added (moved from Weight).
2. Outboard station for a shielded horn is added for all control surfaces.
3. Volume coefficient calculation based on mean geometric quarter chord points of lifting surfaces is added in Canard, Horizontal Tail and Vertical Tail geometry.
4. Menu buttons are rearranged.
5. Lifting surface chord can be calculated for a given spanwise location.

1.5   Propulsion

No Changes

1.6   Stability and Control

1. Zero-angle-of-attack lift and pitching moment coefficient have been moved to Aerodynamics.
2. Take-off rotation is added to Class II analysis and calculates the required horizontal tail or canard area to initiate take-off rotation.
3. Hingemoment: outboard station for a shielded horn is added for all control surfaces.
4. Trim Diagram: forward and aft C.G. calculations are added. d_T is now calculated.
5. Aerodynamic center shift due to fuselage, nacelles, stores, tailbooms and floats is moved to Aerodynamics.
6. Dynamic pressure ratio is moved from Stability and Control to Aerodynamics.
7. Rolling moment due to roll rate accounts for angle of attack now.
8. Steady state airplane lift coefficient accounts for thrust/power component
9. Steady state airplane lift coefficient is input and no longer recalculated in several derivative calculations.
10. Spoiler derivatives account for vented and unvented flap effect.
11. Effects of nacelles and pylons on aerodynamic center are added.
12. Propeller power effects on most derivatives are added.
13. Effect of flaps on downwash gradient is added.
14. Gap effects are accounted for in C_{y_p} C_{l_p} , C_{m_q}

1.7   Dynamics

1. Transfer functions due to spoiler control are added.
2. Flying qualities, Roll Performance accounts for spoilers.

1.8   Loads

No Changes

1.9   Structures

No Changes

1.10   Cost

Cost escalation factor is updated to account for inflation throughout the year 2001, up to September 2002

1.11   General

1. Properties option is added to the file menu
2. Temperature offset is added to all modules requiring altitude input to account for off-standard atmosphere.
3. Project filename can be printed on paper output
4. Notes can have 6 different colors to identify certain stages of the design process. Colors are set in setup and have a hint associated with each different color.
5. Variable labels have been made more consistent.
6. Change Axes window for plotting allows axes default settings to be the same for all flight conditions by checking a check mark. This guarantees the same axes for all plots for all flight conditions.
7. All input/out put windows have a Clear Output button. All output parameters on the open window can be erased with this button.
8. Variables can be held constant (variable is not calculated when the calculate button is pressed) by setting a checkmark in the variable note or on the calculator. The variable is held constant for all flight conditions. The constant variable can be identified by a grayed out box and text. The user can still change the value manually. This option is useful if the user wants to enter his /her own numbers and bypass the calculations.
9. The user can specify which parameters can be exported to an ASCII file in the Notes dialog window.
10. Notes can be added to each flight condition definition in the flight condition dialog window.
11. Export options in the File menu are expanded to include all parameters and flight condition dependent variables only.

12. Flight condition dependent variables can be made flight condition independent in the Notes dialog window.
13. The save button will be grayed out when no new data is entered or modified to indicate that the project does not require saving.
14. The can switch the units user for each parameter in all input/output windows between a default and an alternate unit. Setup allows the user to change specific units for instance change all feet into inches.

2. Bug Fixes

2.1   Weight

1. Class II Weight: airplanes without a rudder are accounted for.
2. Class II Weight: Powerplant, Propulsion System weight does not show a result for GD for a transport airplane
3. Class II Operational Items for GA and fighter airplanes: error message is not clear.

2.2   Aerodynamics

1. Lifting line: geometric twist should be aerodynamic twist.
2. "Other, User Defined" airfoil name is not saved in the project file.

2.3   Performance

Sizing: Wind-milling drag coefficient is added to FAR 25 jet climb drag polars for OEI condition

2.4   Geometry

AeroPack: the airfoil folder is not always displayed when the directory name does not exist on the current computer.

2.5   Propulsion

No Changes

2.6   Stability and Control

1. The graphic for the wing half thickness ratio in the help should show t/2 instead of t.
2. $C_{n_{T\beta}}$: engine inclination angle should be replaced with Toe-in angle. Z-location with Y-location.
3. $dF_r/d\beta$ should have a negative sign in the equation in lateral-directional trim
4. Recalculate all did not calculate drag due to incidence derivative.

2.7 Dynamics

No Changes

2.8 Loads

No Changes

2.9 Structures

No Changes

2.10 Cost

No Changes