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# Internal and External Optimization of a Blended Wing Body for Emergency Evacuation

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# 1 Introduction

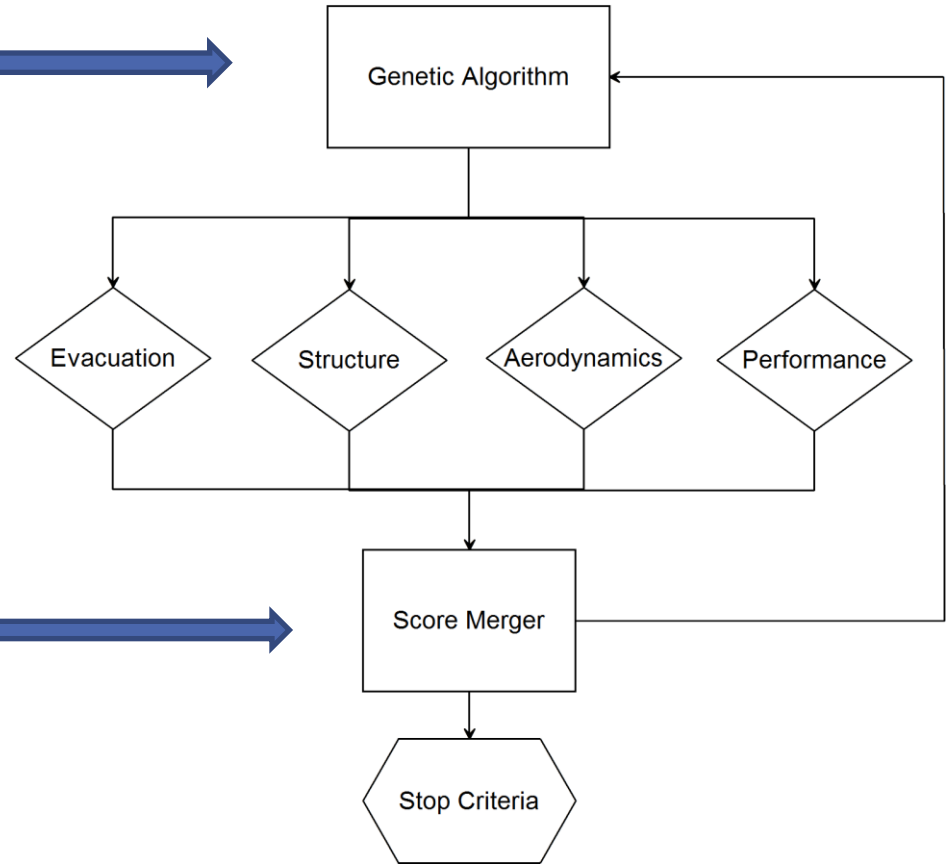
- Importance of general characteristics in aircraft design;
- Lack of knowledge of previous projects;
- Alternative: optimization methods;
- Genetic Algorithm;
- Aircraft Emergency Evacuation Simulation using Ant Colony Optimization (AEES_ACO)
- AHP among TOPSIS-Fuzzy.

# 1 Introduction

Individual Generation

Individual Evaluation for each criterion

AHP + TOPSIS



# 2 Genetic Algorithm

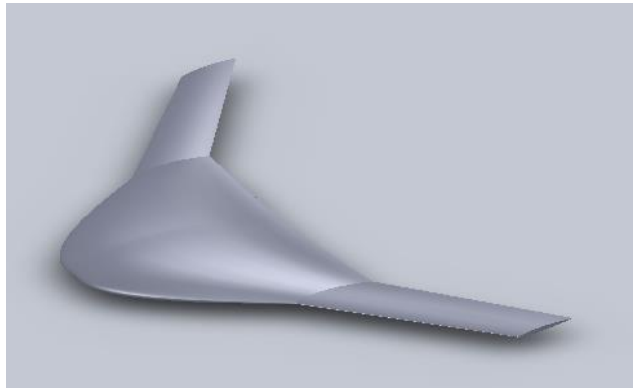
- Effective algorithm based on Natural Selection Theory;
- Each problem solution is an individual;
- Individual characteristics are encoded in “chromossomes”;
- Based on a fitness function, better individuals have best chances in the selection phases;
- Also employs the concepts of crossing-over and mutation;
- After many iterations, the population converge to the fitness function maximum.

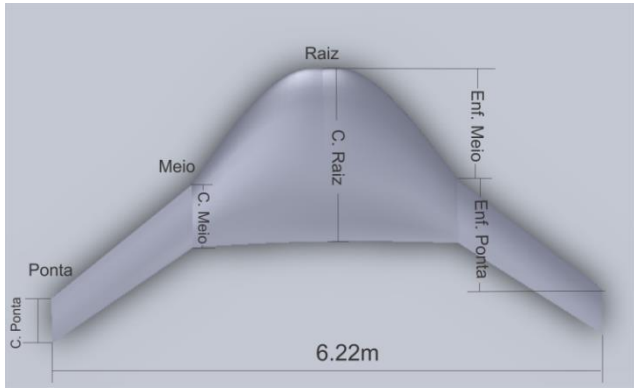
# 3 AHP TOPSIS-Fuzzy

- Method used for multidisciplinary selection problems;
- AHP (Analytical Hierarchy Process) is responsible for the obtainment of the relative weights of each criterion optimized;
- TOPSIS (Technique of Order of Performance by Similarity to Ideal Solution) is used to evaluate the competitors by their characteristics;
- Using these two methods it is possible merge the competitors' scores

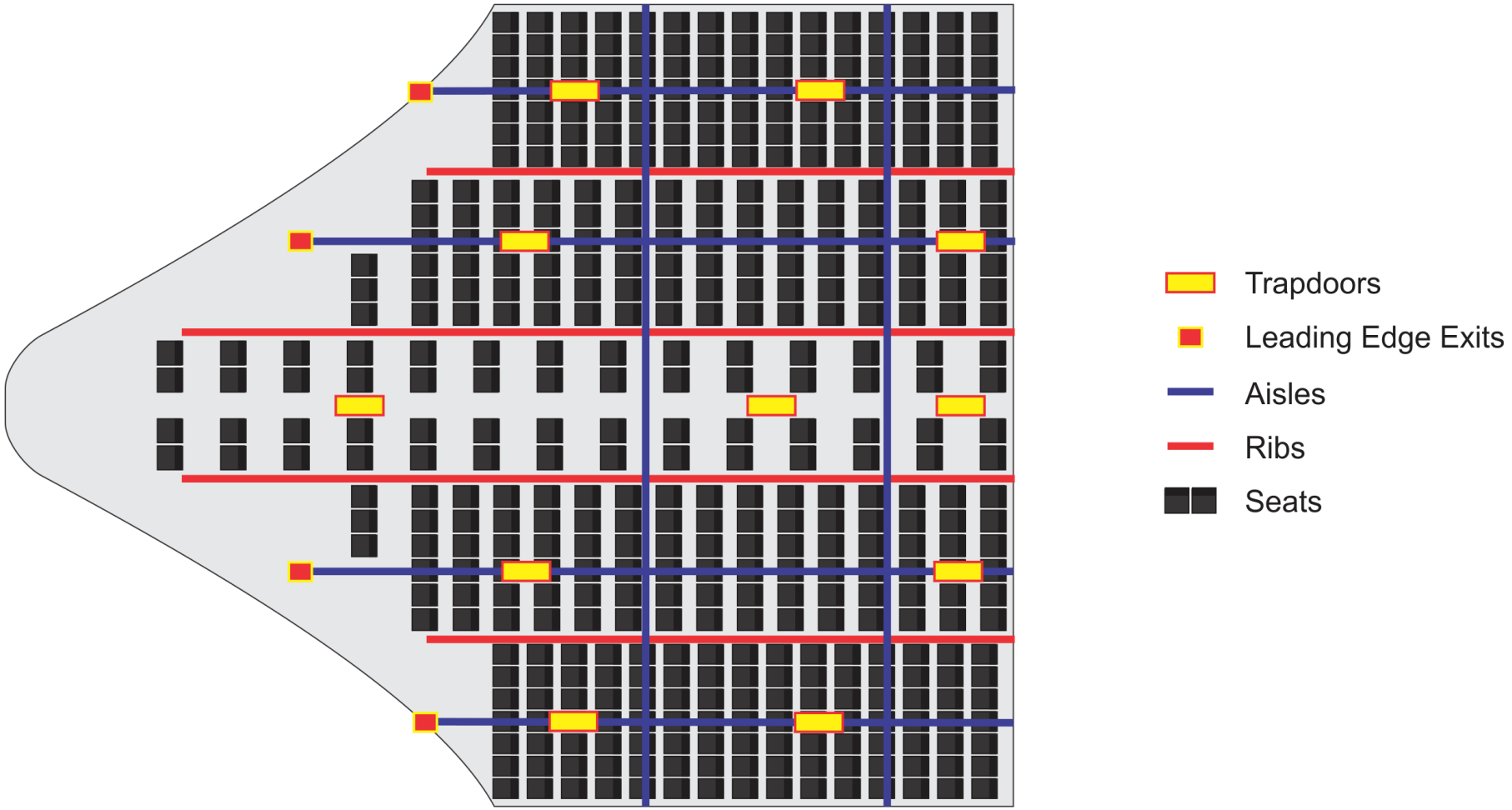
# 4 Individual Generation

- Use of PARSEC + Spanwise Parameters(Chord, Taper, Sweep)
- Geometry processing to determine cabin size
- Use of grid for distribution of aisles
- Distribution of trapdoors, two for each aisle
- Seats limited by structural constraints



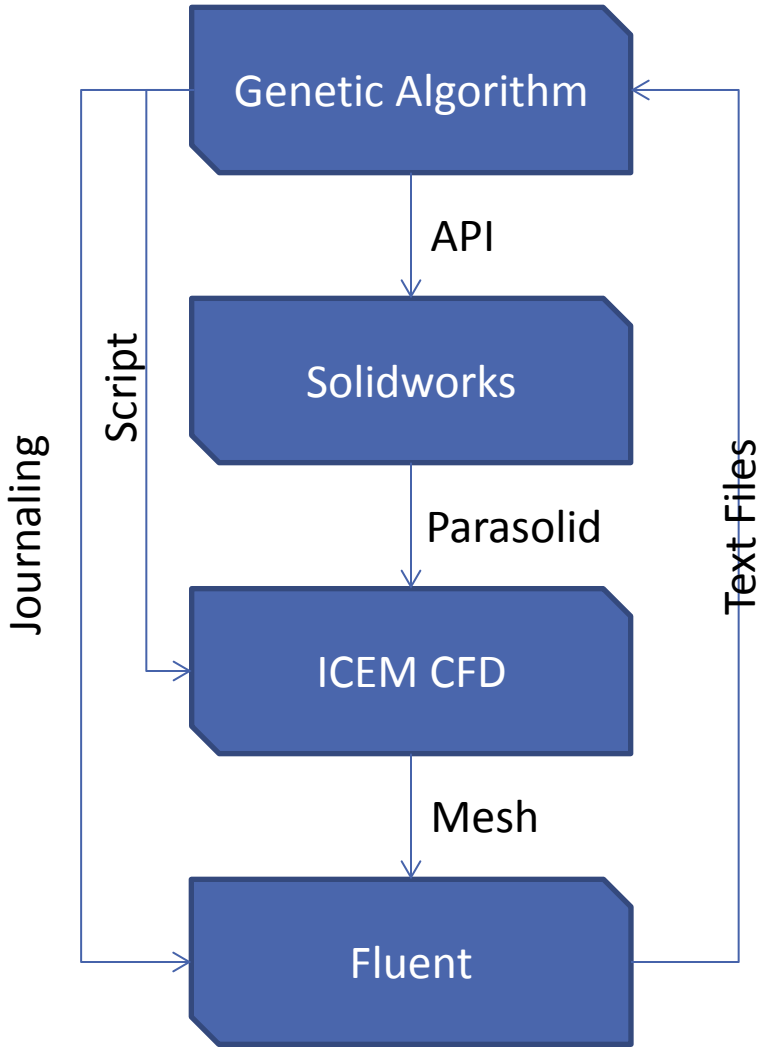


# 4 Individual Generation



# 5 Aerodynamics

- Evaluation using CAD 3D and CFD
- Solidworks + API
- ICEM CFD + Script
- Fluent + Journaling + Text Files
- Network Distribution System
- Possibility : Adaptive mesh

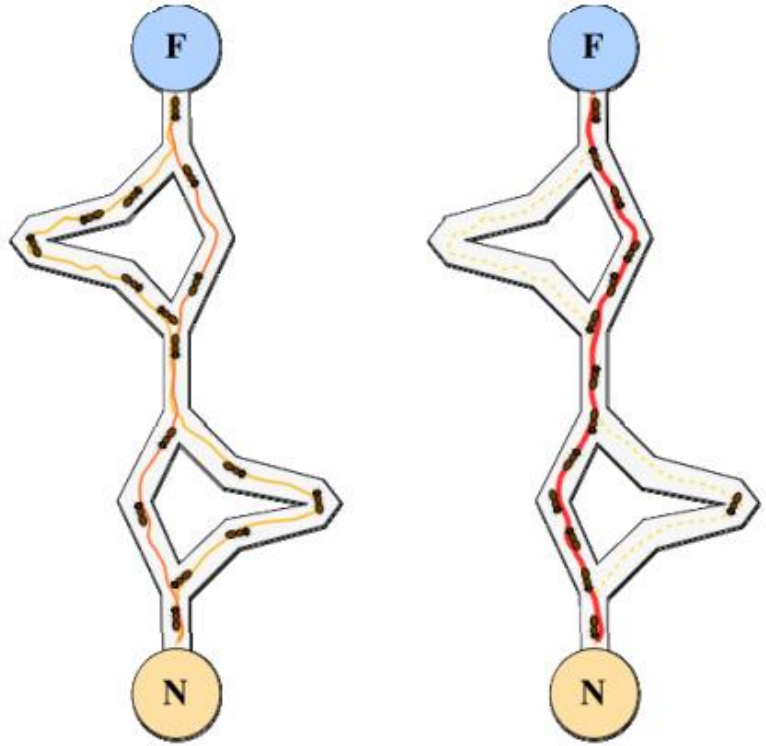


# 6 Performance Estimation

- Aerodynamic data used to determine two performance indicators
- Analytical Mass Estimation
- Numerical integration method
- Fixed Engine;
- Endurance;
- Range.

# 7 AEES_ACO

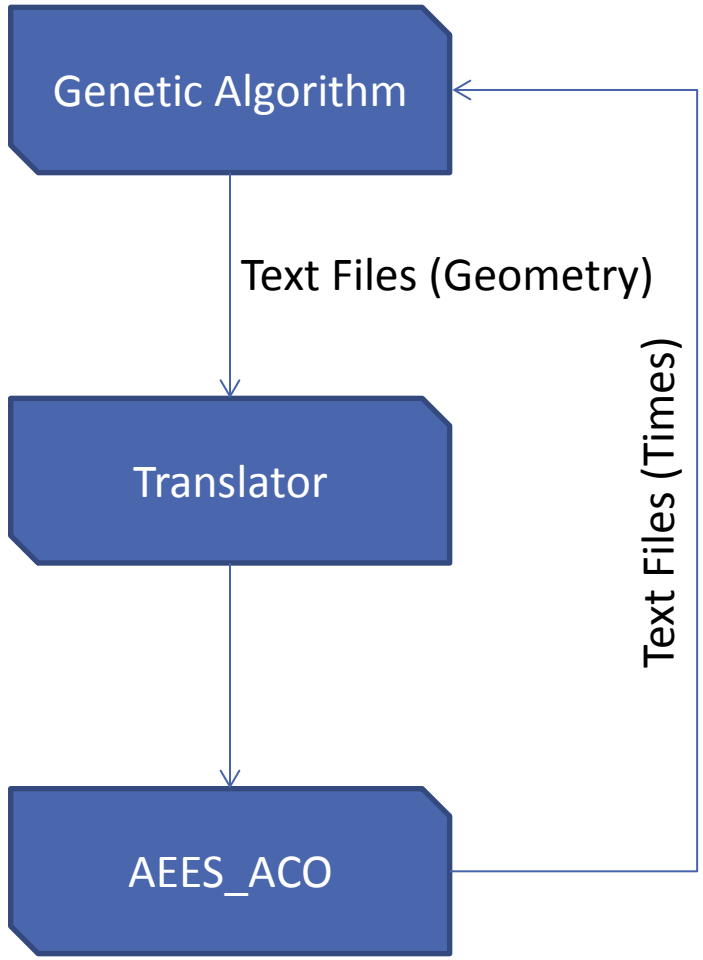
- Based on Ant Colony Optimization
- Used to find the best route to an exit and to simulate behavior of each passenger
- Aided by QFD




Goss et al. 1989, Deneubourg et al. 1990

# 7 Evacuation Estimation

- Random Process
- Run 10 times each individual
- The average time is used to evaluate
- Different doors impeded in each simulation, following the



# 8 FAR 25 Compliance – Passenger Generation

- Each time evacuation estimation is done, a new group of passengers is randomly generated, defining physical and psychological characteristics (Following FAR 25 - Appendix J):
- Gender
- Weight
- Age
- Handicapped
- Nervous / Calm
- Fearful / Courageous

# 8 FAR 25 Compliance – Other Requirements

- Pre-configured distribution of carry-on baggage and other similar articles at aisles and near emergency exits
- Time used to pass through an exit should be measured in order to feed the system and correctly simulate the test

# 8 Acknowledgements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