Simulation of Emergency Evacuation with Optimization of the Internal Configuration of the Aircraft Using Ant Colony Optimization (ACO)

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Introduction. To certify a passengers aircraft, it must be subjected to the emergency evacuation certification test. In the test, it must be demonstrated that the model and the configuration of the aircraft allow a full capacity evacuation of passengers and crew in 90 seconds or less, using its emergency exits with the help of the flight attendants.
The costs of these tests are very high and expose occupants participating in the tests at risk of injury since the occupants are volunteers and have no prior knowledge of the aircraft.
Objectives. The computational tool developed aims at simulating formal testing of emergency evacuation of aircraft, finding optimal solutions that meet the requirements imposed by the aviation authorities, required to certify the aircraft.
The simulations are inexpensive and simple and the aim of this work is to find satisfactory solutions and optimize them on procedures and escape routes depending on the configuration of each aircraft. Also the objective is to ensure the success of the operation and to decrease the costs and risks of the actual required testing. **Methodology**. "Ant colony" algorithms were inspired by the behavior of ants in search of food regarding to work organization and cooperation among themselves. The communication of ants is performed by means of pheromones, chemicals produced by animals that allow mutual recognition of individuals. Some species of ants use pheromones to mark trails and just walk around. The ants use these trails to move the nest to a particular food source.
The proposal is to use the Ant Colony Algorithm (ACO) to optimize the interior of the aircraft for better comfort and safety to passengers there is a need for emergency evacuation of the aircraft. The description of this methodology is presented next. Deneuboug, Aron, Goss, and Pasteels performed an experiment with ants searching for food. They put two double bridges between the colony and the food and observed the behavior of these insects. Initially, the ants were moving randomly in search of food, exploring possible solutions. When they found food, returned to the colony depositing pheromone on the path. A larger quantity of this pheromone means that more ants have found this path, increasing the likelihood that this is the best route. Thus, this path has become an optimized solution based on the level of pheromone found. The results showed that ants circled the way with larger amount of pheromone. The deposit of the substance stimulated more ants to choose the more pheromone concentrated path. This means that the solution converged to that solution. Little-used paths lose pheromone by evaporation, reducing the likelihood over time of an ant using it.The ant colony algorithm was created in 1992 by Marco Dorigo using artificial ants to mark and track trails. **Conclusions** The ACO has proved of great value to the solution of the TSP, and holds great promise for optimizing routes and geometries. Its major use today, besides the TSP, is optimization of structural parts. However, a study has been done to use it in geometry optimization of aircraft. So, as briefly explained, the ACO can be used for the analysis of aircraft emergency evacuation.