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Conflict-free trajectory optimization using B-Splines and Genetic Algorithm

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Conflict-free trajectory optimization using B-splines and Genetic Algorithm

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Main Idea : Our methodology aims to generate optimal conflict-free trajectories for an en-route conflict situation. The genetic algorithm (GA) pilots the B-splines through their control points. Consequently, trajectories are directly monitored by the GA which handles both deconfliction and optimization.

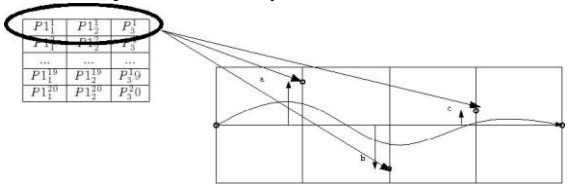
Our methodology:

- ✓ A combination between a stochastic optimization method and a smooth trajectory model: Genetic Algorithm (GA) B-splines
- ✓ B-splines are controlled by GA via their control points

Trajectory model and chromosome encoding

- B-splines are calculated from the control points designed by the GA
- One trajectory is determined by its control points

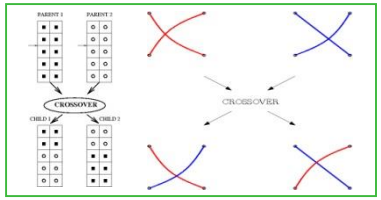
A chromosome contains the control points for all the aircrafts involved



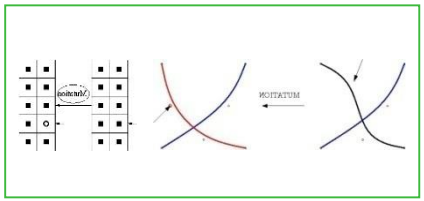
Optimization method: Genetic algorithm

A population of solution (chromosome) evolves using evolution concepts

Crossover

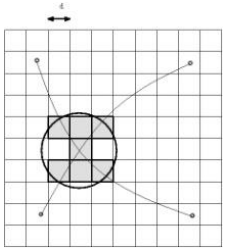


Mutation

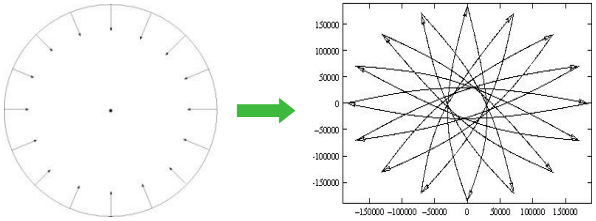


Conflict detection and fitness calculation :

- Fitness expression:
- Conflict detection using a space discretization:
  1. Fill each cell with entry and exit time for each airplane
  2. Check for time conflict the eight neighboring cells for each cell



The roundabout test problem resolution



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