

# A New Algorithm for Automated Aircraft Conflict Resolution

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## NextGen and SESAR Context

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- There is need for automated conflict resolution, several methods exist among which Navigation Functions and Genetic Algorithm,
- The most important parameter to deal with is TIME .



# Automatic Resolution: Navigation Functions

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- Dipolar Navigation Function makes the resulting lines of potential field tangent to the desired orientation at the goal.

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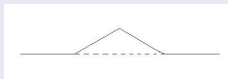
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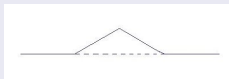
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- The Offset model:





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- A very good solution may eliminate worst solutions  $\Rightarrow$  Prematurely convergence.

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## Principles of the light propagation method

The light beams are launched from the starting point in the half sphere towards the point of arrival. The congested areas are represented by areas of high index. The first beam that reaches the point of arrival represent the optimal trajectory.

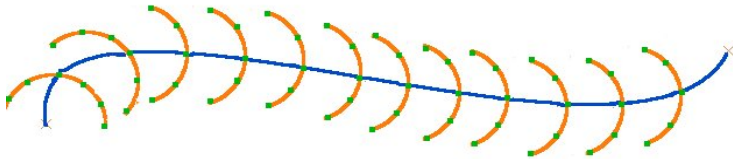


# The light propagation algorithm



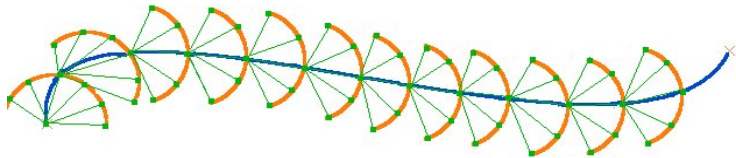
- Find the potential fields algorithm solution: the trajectory  $T \Rightarrow$   **AIRBUS**  
UpperBound = time travel of  $T$

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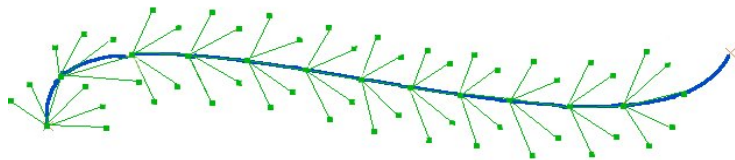
- Sample  $T$  to build a tree, with half spheres with a radius  $dt$ , a curvilinear step  $ds$  and an angle  $d\theta$

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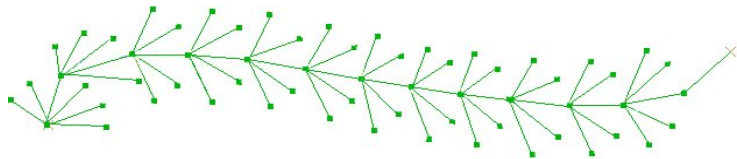
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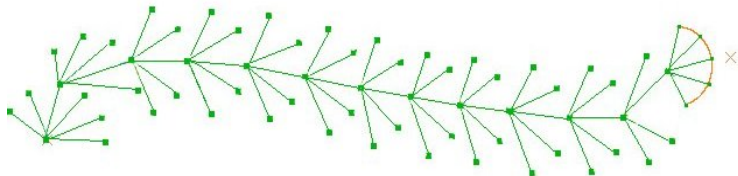
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- While there is still unexplored nodes in the tree do

- Choose a node N from the tree.
- Update the environment index.
- Relaunch rays from node N:

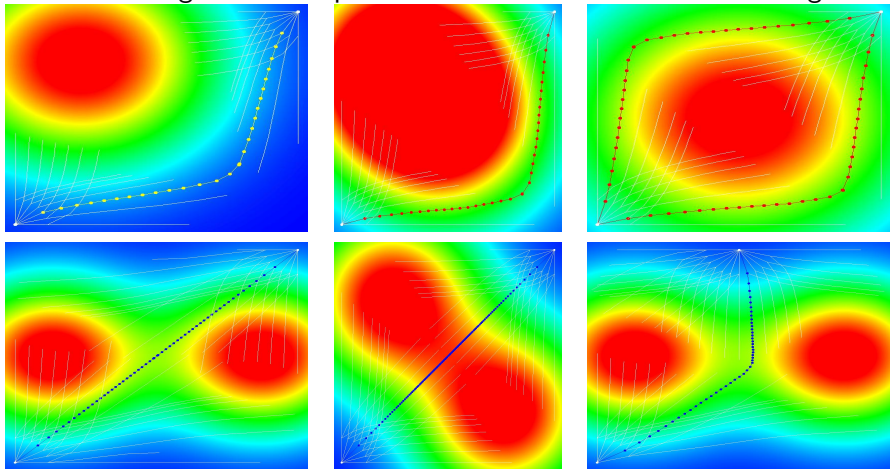
For any light ray if the light beam initially in a media index  $n_1$ , encounter an environment index  $n_2$  with a corner radius  $i_1$ , it continues with a new angle  $i_2$  such that  $n_1 \sin i_1 = n_2 \sin i_2$ .





# Experimental results

A simplified version of the algorithm is implemented in 2D with static areas of congestion.



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## Future work

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- Allow dynamic congested area,
- Convergence proof of the algorithm,
- Quantitative and qualitative comparison with other method.