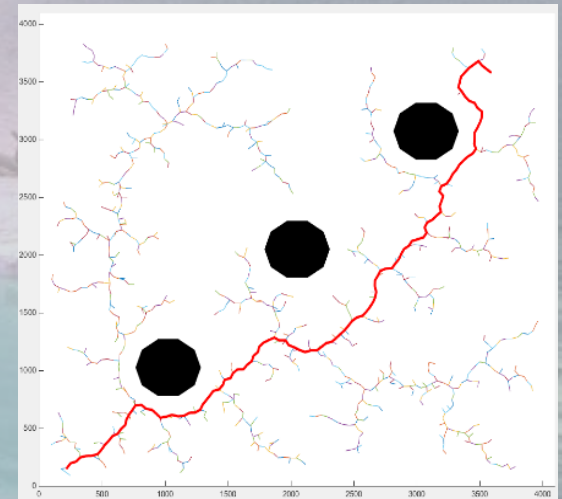
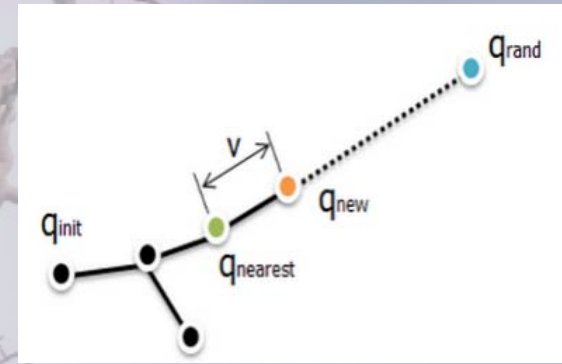


# Optimal Random Sampling Based Path Planning on FPGAs

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## Introduction

The RRT (Rapidly-exploring Random Tree) use a stochastic search over the body-centered frame of reference, and explores the configuration space by rapidly “growing” a tree, which consists of way points and satisfies the dynamic constraints of the vehicles. As the further improved algorithm of RRT, the RRT\* can optimize solution path by adding the “cost review” after tree extending.



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On the other hand, the original RRT experiences the bottleneck of complicated iteration and it becomes worse in RRT\*. We develop hardware architecture for RRT\* to exploit its parallel potential and realize the acceleration:

- The “tree extension” and “cost review” are separated as independent processes and executed in parallel, unlike the original sequential execution.
- For the complicated vertex inserting operation, pipelined Kd-tree constructor is designed for fast Kd-tree rebuilding when new vertex generated.
- To speed up the near neighbor search, the vertexes are stored in separate Kd-trees and search processes can be carried out concurrently

