

Fast Path Planning using Motion Graphs

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INTRODUCTION

Search methods applied to motion graphs [1] [2] are able to automatically find transitions with the goal of synthesizing different motion tasks from a given initial set of captured motion clips.

However, the computation time needed to search and extract motions from the graph rapidly increases as 1) the number of motion clips in the graph grows and 2) the motions to be synthesized get longer, as for instance for the execution of complex collision-free locomotion sequences for following paths.

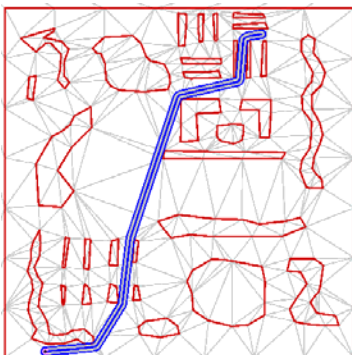
In order to achieve a fast solution for the particular case of following given paths we divide the problem in two parts: 1) We label (automatically or manually) few nodes and edges of the motion graph which are suitable for performing simple path following behavior when possible, 2) we only search for combinations of motions in the graph for the needed sections of the path.

Approach

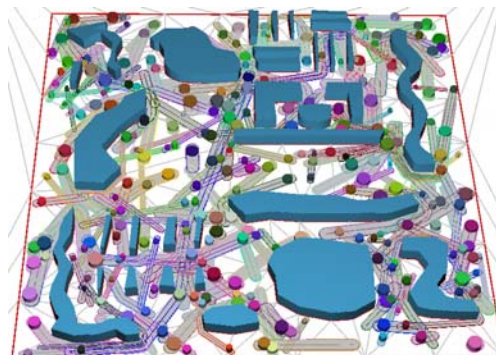
We employ our triangulation-based algorithm for fast computation of collision-free paths in 2D [3]. The generated paths have a well defined structure: they are composed of a sequence of straight-line segments and arcs of circle. Given a path to be followed our approach is mainly composed of two parts:

- 1) No search is employed when the character is following a straight segment of the path. The motion clip(s) labeled as walking forward is/are repetitively applied to the character and a simple orientation correction is able to keep the character extremely close to the path segment.
- 2) When the next arc of circle in the path is approached, a combinatorial A* search over the motion graph is quickly performed only until the character is again closely aligned with the next straight segment of the path. A transition back to straight-line following behavior is then employed.

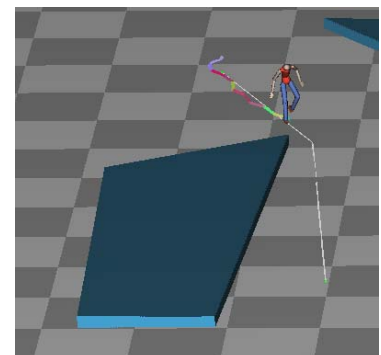
Corridors with desired clearance radius can be retrieved efficiently from a triangulated domain [3].



The same triangulated domain can be used for retrieval of corridors of different sizes.



The combined path following and Motion Graph search is then used to follow the path.



References

- [1] O. Arikan, D. A. Forsyth, and J. F. O'Brien, "Motion synthesis from annotations," SIGGRAPH'03, vol. 22, no. 3, pp. 402–408, 2003.
- [2] L. Kovar, M. Gleicher, and F. H. Pighin, "Motion graphs," SIGGRAPH'02, vol. 21, no. 3, pp. 473–482, 2002.
- [3] M. Kallmann, "Robust navigation meshes from polygonal obstacles," in ACM SIGGRAPH Symposium on Interactive 3D graphics and Games (I3D'07), Poster Presentation, Seattle, April 30 - May 2 2007.