Partially overlapping segments

This file shows the example of partially overlapping segments and explains the approach taken to remedy it (implemented in “removePartiallyOverlappingSegments” function).

This is a graphical depiction of the partially overlapping segments problem drawn using XFEMM:



There are 2 segments in the above plot. One segment connects nodes 1 and 3, while another segment connects nodes 2 and 4. The region between nodes 2 and 3 is common to both segments. The purpose is to remove these two segments from the FemmProblem struct and add three new segments so that these new segments do not overlap. In the given example, three new segments should be between nodes 1 and 2, 2 and 3, 3 and 4.

The function “removePartiallyOverlappingSegments” consists of four main steps to solve the problems similar to the one above. These steps are explained below:

1. Detect partially overlapping segments. For each segment, k and b values are found using the line equation y = kx + b. If two segments have the same values of k and b, and if one end node of one segment lies between the end nodes of another segment, then these segments are considered to overlap partially. For vertical segments, partial overlapping is determined based on the y coordinate of nodes since k can be plus or minus infinity.
2. Add three new segments to the end of FemmProblem struct so that these new segments do not overlap with each other. Nodes are sorted based on their x or y coordinates (based on the value of k) and reconnections are made.
3. Delete old segments.
4. Delete zero length segments. If one end node of one segment is the same as one end node of another partially overlapping segment, then a segment connecting a node to itself is created as a result of step 2. This step deletes these zero length segments.