Partially overlapping arc segments. Case 1

This file shows the example of partially overlapping arc segments and explains the approach taken to remedy it (implemented in “removePartiallyOverlappingArcSegments” function). In this case, start nodes of both arcs are in the first quadrant.

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



There are 2 arc segments in the above plot which have the same centers. One arc segment connects nodes 1 and 3, while another arc segment connects nodes 2 and 4. The region between nodes 2 and 3 is common to both arc segments. The purpose is to remove these two arc segments from the FemmProblem struct and add three new arc segments so that these new arc 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 “removePartiallyOverlappingArcSegments” consists of four main steps to solve the problems similar to the one above. These steps are explained below:

1. Detect partially overlapping arc segments. If two arc segments have the same center and radius, and if the θ of one end node of one arc segment lies between the θ-s of end nodes of another arc segment, then these arc segments are considered to overlap partially. Here, θ of a node means its angle in polar coordinates measured with respect to local coordinates (arc center is an origin). In other words, it is the angle between the positive direction of x-axis and a line connecting the node and the arc center.
2. Add three new arc segments to the end of FemmProblem struct so that these new arc segments do not overlap with each other. Nodes are sorted based on their θ-s and reconnections are made (θ increases in the counterclockwise direction).
3. Delete old arc segments.
4. Delete zero length arc segments. If one end node of one arc segment is the same as one end node of another partially overlapping arc segment, then an arc segment connecting a node to itself is created as a result of step 2. This step deletes these zero length arc segments.