

1077-53-1756

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Initializing passive sonar tracks in three dimensions leads naturally to the problem of rectifying cone-sphere intersections where the vertex of the cone lies inside or on the surface of the sphere. If the exterior plane of the cone contains the center of the sphere, then the projection of the cone-sphere intersection onto the exterior plane of the cone is a circle. We call such cone-sphere intersections (generalized) Viviani curves since they are the same as certain cylinder-sphere intersections. Rectification of Viviani curves results in hyperelliptic integrals which we express in terms of elliptic integrals by carefully applying a few changes of variable. Then we use Jacobi functions and power series techniques to carry out the rectification, with arbitrary precision. (Received September 21, 2011)