NOTE ON THE OPTIMAL INTERCEPT TIME OF VESSELS TO A NONZERO RANGE

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Abstract. There is an even simpler solution to the optimal intercept problem of vessels to a nonzero range.

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In [1] the authors consider the problem of a patrol vessel trying to intercept a target vessel. The goal of the patrol vessel is to get within a specified distance of the target vessel. Both vessels are traveling at constant speed on a plane. What is the minimum time needed for the patrol vessel to get there ?

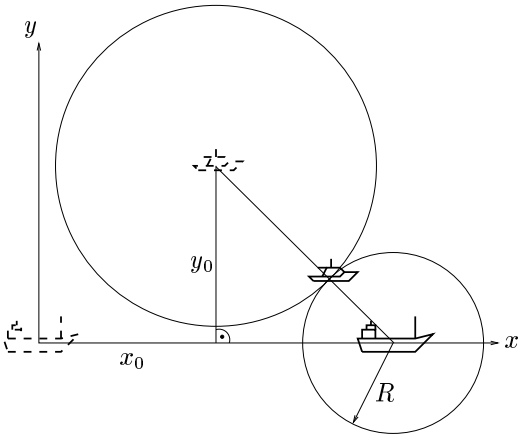

FIG. 0.1. *Figure indicating the solution*

Suppose the target vessel is initially located at $(0,0)$ and travels with speed v along the x-axis, while the patrol vessel is initially located at (x_0, y_0) and travels with speed u to get within the specified distance R of the target vessel. Then think of a circle centered at the location of the target vessel with radius R moving to the right and a growing circle with radius ut centered at the initial location of the patrol vessel (x_0, y_0). The patrol vessel can reach its goal first when the two circles touch, as shown in figure 0.1. Hence the shortest time t to reach this goal is a solution of the quadratic

$$y_0^2 + (vt - x_0)^2 = (ut + R)^2.$$

REFERENCES

[1] B. U. Nguyen and D. Nguyen, *Optimal Intercept Course of Vessels to a Nonzero Range*, SIAM Rev., 38 (1996), pp. 647-649.

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