GUIDANCE BY REPULSION MODEL: OPTIMAL STRATEGIES AND SIMULATIONS

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A common strategy to solve the guidance problem is the "follow me" strategy, based on the attraction that a guiding agent exerts on other agents [2], [3], [4], [5].

In our recent work [1], we propose to solve the guidance problem from a novel viewpoint, based on the use of repulsive forces, in what we have called a "move away from me" strategy. Repulsion forces are mostly used for collision avoidance or describing the need of personal space [5], [6]. A recent work [7] shows how repulsion forces can be used to describe a defender-intruder interaction, where the defender repels the intruder to keep it away from a protected target.

We present a "guidance by repulsion" model describing the behaviour of two agents, a driver and an evader. The guide follows the guided but cannot be arbitrarily close to it, while the evader tries to move away from the driver beyond a short distance. The key point of the guidance maneuver is that the driver can display a circumvention motion around the evader, in such a way that the trajectory of the evader is modified due to the repulsion that the driver exerts on the evader.

With this model, we show that the evader can be guided to any target on the plane or to follow a sufficiently smooth path by adjusting a single parameter which controls the driver's behaviour, activating or deactivating the circumvention mode and selecting the clockwise/counterclockwise direction of the circumvention motion.

We propose different open loop strategies to drive the evader from any given point to another assuming that both switching the control and keeping the circumvention mode active have a cost. Finally, we develop a feedback law which prevents the excessive use of the circumvention mode and gives rise to a significant reduction of the cost.

References

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