

Detection of collision events on curved trajectories: Optical information from invariant rate-of-bearing change

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Abstract. We present a method for detecting collision events on curved trajectories. The method is based on the invariant rate-of-bearing change (IRBC) and is applicable to both straight and curved trajectories. The IRBC is a scalar quantity that is invariant to the observer's position and velocity. It is shown that the IRBC is constant for straight trajectories and varies linearly for curved trajectories. The method is applied to a set of simulated trajectories and the results are compared with a standard method based on the rate-of-bearing change (RBC). The IRBC method is shown to be more robust to noise and more accurate than the RBC method.

1. Introduction. The problem of detecting collision events on curved trajectories is a fundamental problem in navigation and robotics. In this paper, we present a method for detecting collision events on curved trajectories. The method is based on the invariant rate-of-bearing change (IRBC) and is applicable to both straight and curved trajectories.

The IRBC is a scalar quantity that is invariant to the observer's position and velocity. It is shown that the IRBC is constant for straight trajectories and varies linearly for curved trajectories. The method is applied to a set of simulated trajectories and the results are compared with a standard method based on the rate-of-bearing change (RBC).

The IRBC method is shown to be more robust to noise and more accurate than the RBC method. The IRBC method is also simpler to implement than the RBC method. The IRBC method is applicable to both straight and curved trajectories.

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The IRBC method is also simpler to implement than the RBC method. The IRBC method is applicable to both straight and curved trajectories.

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EXPERIMENT 1
Linear and Circular Trajectories

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d'

((1 0). d')

.05)

2.0 3.25

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Bias. β

4 () \times 2 ()

$F(1,) = 0. 2)$

$F(3,21) = 0.$

(> .05).

$F(3,21) = 2.1, > .05$

EXPERIMENT 2

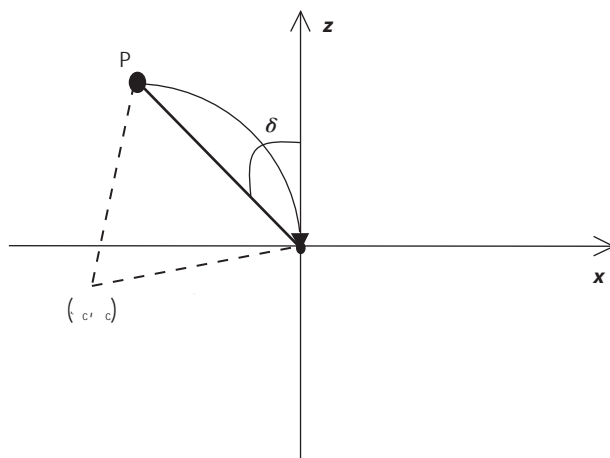
1,

d' (1 0).

4.5- 5.5- ,
 3.5- ,
 2, 3, , , , 110-, 225-, 255-, 315-, 410-,
 550- 2.0-
 0, 0, 2, 5, , 110-, 225-, 255-,
 315-, 410-, 550-

Bias. β 4 () \times ()
 $F(3,21) = 4.$
 $(\alpha < .05).$ β

APPENDIX



$$\begin{aligned} \dot{r} &= \dot{r} \cos \delta - r \dot{\delta} \sin \delta \\ \dot{z} &= \dot{r} \sin \delta + r \dot{\delta} \cos \delta \end{aligned} \quad (1)$$

$$\dot{r} = \dot{r} + \dot{\delta} \cdot (r \sin \delta) \quad (2)$$

$$\delta = \arcsin\left(\frac{z}{r}\right) \quad (3)$$

$$\dot{\delta} = \frac{d}{dt} \delta = \frac{d}{dt} \left[\arcsin\left(\frac{z}{r}\right) \right] = \frac{1}{\sqrt{1 - \left(\frac{z}{r}\right)^2}} \cdot \frac{d}{dt} \left(\frac{z}{r}\right),$$

APPENDIX (
