Errata

Optimal Guidance Law in the Plane

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APPENDIX A contained a typographical error in Eq. (A1) and several misnumbered citations of other equations. The corrected text follows.

Appendix A: Solution of the Adjoint Equations

From Eqs. (13) and (16)

$$\lambda_x = -1 \tag{A1}$$

Rewriting Eqs. (9) and (10) and taking into account Eqs. (1) and (2)

$$\dot{\lambda}_\theta = \lambda_\theta \dot{r}/r - \lambda_r \dot{\theta} \tag{A2}$$

$$\dot{\lambda}_r = \dot{\lambda}_\theta \dot{\theta}/r \tag{A3}$$

A solution for the system of Eqs. (A2) and (A3) of differential equations in terms of r and θ is given by

$$\lambda_\theta = c_1 r \cos(\theta + c_2) \tag{A4}$$

$$\lambda_r = c_1 \sin(\theta + c_2) \tag{A5}$$

where c_1 and c_2 are constants of integration. This can be readily proved by direct substitution of Eqs. (A4) and (A5) into Eqs. (A2) and (A3). This solution was first pointed out in Ref. 13.

Substituting Eqs. (A4) and (A5) into Eq. (11) and rearranging yields

$$\dot{\lambda}_\gamma = c_1 V_p \cos(c_2 + \gamma_p) \tag{A6}$$

Substituting Eq. (17) into Eq. (3) yields

$$\dot{\gamma}_p = \lambda_\gamma / 2kV_p^2 \tag{A7}$$

From Eqs. (A6) and (A7), it follows that

$$\frac{d\lambda_\gamma}{d\gamma_P} = 2V_p^3 c_1 k \cos(c_2 + \gamma_p)/\lambda_\gamma \tag{A8}$$

Rearranging, integrating, and taking into account Eq. (14) yields

$$\lambda_\gamma^2 = 4_p^3 c_1 k [\sin(c_2 + \gamma_p) - \sin(c_2 + \gamma_{p_f})] \tag{A9}$$

We shall now find the values of c_1 and c_2. At $t = t_f$ Eqs. (4), (13), and (A4) imply that

$$c_1 R \cos(\theta_f + c_2) = 0 \tag{A10}$$

Thus

$$c_2 = \pi/2 - \theta_f + n\pi \tag{A11}$$

Due to the fact that we are dealing with a free end time problem, the Hamiltonian satisfies

$$H_f = 0 \tag{A12}$$

Taking into account Eqs. (13-16) and (19), it follows that

$$H_f = \lambda_{r_f} \dot{r}_f - 1 = 0 \tag{A13}$$

where

$$\dot{r}_f = V_E \cos(\theta_f - \gamma_{E_f}) - V_p \cos(\theta_f - \gamma_{p_f}) \tag{A14}$$

Recalling Eqs. (A11) and (A5) yields

$$H_f = \pm c_1 \dot{r}_f - 1 = 0 \tag{A15}$$

Thus

$$c_1 = \pm 1/\dot{r}_f \tag{A16}$$

Substituting c_1 and c_2 into Eqs. (A4), (A5), and (A9) yields

$$\lambda_\theta = \frac{r}{\dot{r}_f} \sin(\theta_f - \theta) \tag{A17}$$

$$\lambda_r = \frac{1}{\dot{r}_f} \cos(\theta_f - \theta) \tag{A18}$$

$$\lambda_\gamma^2 = \frac{4kV_p^3}{\dot{r}_f} [\cos(\theta_f - \gamma_p) - \cos(\theta_f - \gamma_{p_f})] \tag{A19}$$

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