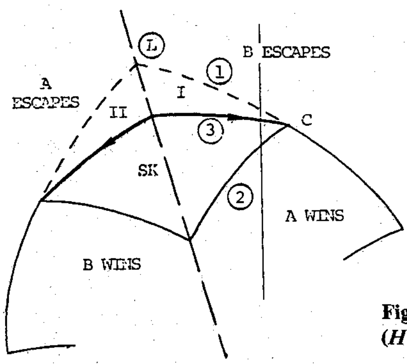

Fig. 2 Reduced SK region ($H=150$ deg, $\beta=2$).

For $H=150$ deg and $\beta=2$ we find, not surprisingly, that A is turning left on ③ instead of right, as on ①. (For headings $H<125$ deg, approximately, however, A's switch-function can change sign during the maneuver 3.)

Does A risk defeat by adopting a cooperative stategy when the position is in the escape zone I, which was part of the simultaneous kill region in Fig. 1?

The answer is no. Suppose B turns toward A but A, for a while, turns away from B. The position will now move towards the (reduced) SK region and may even cross the line Ⓛ. However it cannot reach B's win region without passing through the SK region. A of course, will turn toward B before B's win region is reached.

Starting in zone I, B should, of course, turn away from A, so that if A cooperates the path will move to the right and pass above corner C, after which B can escape no matter what A does. If B sees that the path is going to pass below C, because A has not cooperated, he must, of course, turn toward A before A's win region is reached, and a simultaneous kill results. Identical considerations apply to zone II, with the roles of A and B interchanged.

Reference

[1]Merz, A.W., "To Pursue or To Evade—That is the Question," *Journal of Guidance, Control, and Dynamics,* Vol. 8, March-April 1985, pp. 161-166.

Reply by Author to J.V. Breakwell

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WITH regard to the preceding Comment on Ref. 1, optimization problem solutions normally require the performance criterion to be specified a priori, but the air combat problem can be solved in this way only for "set-up" initial geometries, when the roles are apparent. More generally, the min-max interests of the pilots, and the corresponding solutions, depend on the state itself, as shown in Fig. 2 of the Comment. This solution seems to answer long-standing practical criticism of the differential-game modeling of the air combat problem, in that the offensive and defensive interests of both pilots are generally present. Barriers separating different closed state regions are found, and these solutions are comprehensive in that realistic *options* of the nominal evader are identified, together with corresponding tactics of the nominal pursuer.

Reference

[1]Merz, A.W., "To Pursue or to Evade—That is the Question," *Journal of Guidance, Control, and Dynamics,* Vol. 8, March-April 1985, pp. 161-166.

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Book Announcements

BILLINGS, S.A., GRAY, J.O., and **OWENS, D.H.,** editors, ***Nonlinear System Design.*** Peter Peregrinus, Stevenage, England, 1984, 192 pages. $32.00.

Purpose: This text has ben conceived in the belief that sufficient material is now available in applications areas where nonlinear effects are dominant to make an up-to-date state-of-the-art overview useful both to researchers in the field and to industrial users. The text aims to present techniques for coping with nonlinearities in control systems at all stages of the design process.

Contents: An overview of nonlinear systems theory (D.P. Atherton). Identification of nonlinear systems (S.A. Billings). Stability criteria for nonlinear systems—a survey (P.C. Parks). Frequency domain methods in the analysis and stability of nonlinear feedback systems (C.J. Harris, R.K. Husband). Stability and performance deterioration due to modeling errors (D.H. Owens, A. Chotai). Harmonic analysis of nonlinear feedback systems (J.O. Gray, L.S. Brown). Optimization-based design of nonlinear control systems (D.Q. Mayne). A design methodology for nonlinear systems (G.T. Russell). Nonlinear analysis and modelling during the development of an aircraft incidence limiting system (C. Fielding). The implications of the control surface actuation system on flight control system design (B. Gee). Some nonlinear design aspects of position control systems and regulators (P. Bowler).

CASTI, J.L., International Institute for Applied Systems Analysis, ***Nonlinear System Theory.*** Academic Press Inc., New York, 1985, 261 pages. $45.00.

Purpose: This text has been written as a reference guide to the current status of certain aspects of nonlinear system theory and, as such, is not an introductory text. The mathematical approach is algebraic and geometric in nature, thereby avoiding methods of classical and functional analysis. Finally, some aspects of nonlinear system analysis have been omitted by design. These include systems defined by partial differential equations, systems with differential delay, and stochastic systems.

Contents: Perspectives and problems of nonlinear system theory. Mathematical tools of nonlinear system theory. A modern view of linear system theory. Reachability and controllability. Observability, realization, and estimation. Stability theory: singularities, bifurcations, and catastrophes.