

Target Tracking and Binocular Vision Control with Human Head and Eye

Bijoy K Ghosh

Professor, Dept of Mathematics and Statistics
Texas Tech University, Lubbock, TX 79409, USA

Abstract

We study problems that can be applied to controlling the rotational motion of a pair of human eyes on a rotating head. Eyes and head move to acquire a point target and the control task is to direct the eye-pair towards the general target direction and, if the target is close by, to focus on the target. Roughly speaking, the former task is accomplished by *versional eye movements* and the latter task of pinpointing the eyes on a specific point is accomplished by *vergence eye movements*. A cost function that minimizes the control energy has been chosen and the corresponding *optimal trajectories* are synthesized. Typically, an optimal controller is implemented in the open loop, which *simultaneously tracks* the two eyes to track and focus on a stationary target. We have also implemented a numerical solution scheme to analyze the corresponding Hamilton Jacobi Bellman equation to synthesize, in the *closed loop*, *asymptotically stabilizing* controllers that stabilize the eye pair on a target. Finally we also synthesize in the closed loop, a state feedback controller that *linearizes the eye and the head movement control systems* with respect to a suitably chosen input output pair. The linear control system has also been used to asymptotically stabilize the two eyes on to the target and the head towards the target.

