

Optimal Control Strategies for Human Eye Movement: Minimum Energy or Arc Length?

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Abstract: We discuss problems that can be applied to controlling the rotational motion of human eyes. The Eyes 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. In this talk we propose to address an unresolved open question – Are the two eyes controlled separately or synchronously? Using a dynamic model of the eye movement system, introduced recently in our laboratory, we compute the optimal energy required by the two eyes to separately track a chosen target trajectory. Subsequently we control the versional eye movement using a synchronous control and the vergence component as an additional control separately for both the eyes. The versional controller is synthesized using a minimum energy or minimum arc length optimal control system. The total energy required for the synchronous controller is compared with the total energy required for the independent controller and the results will be discussed in the talk.