

From Delayed to Non-delayed Optimal Control Problems: a Reduction Method

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Abstract

Optimal control problems with time delay have numerous applications across various fields. Many economic systems do not react instantly but with a delay to changes in external influences (e.g., investment-lags, transportation-lags, etc.). Moreover, in recent years, optimal control problems with time delay were formulated in the study of tuberculosis model, representing the delay on the diagnosis and start of treatment of infected individuals [2], and in models of response to anticancer treatment [3].

The goal of the presentation is to explain a method, by T. Guinn [1], designed to convert a broad class of optimal control problems involving a fixed time delay, into equivalent standard, non-delayed formulations. Rather than relying on intricate proofs to obtain necessary conditions for delayed control theory, the proposed approach employs a change of variables over stepwise time intervals to reformulate the delayed dynamic equations and constraints into a higher-dimensional un-delayed system. This structural reduction allows to directly apply well established classical necessary conditions such as Pontryagin's maximum principle.

Ultimately, the power of this method is shown through an example, by allowing us to avoid the solution of the delayed system at the cost of higher dimensionality [4].

References

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