Integral Transformations of Infinite Horizon Optimal Control Problems

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Abstract: We discuss the following optimal control problem with infinite horizon (IHOCP): Minimize the functional

$$J(x,u) = \int_0^\infty r(t,x(t),u(t))dt$$

subject to all admissible pairs (x,u), satisfying the state equation,

$$\dot{x}(t) = f(t,x(t),u(t)),$$

the control constraints

$$u(t) \in U,\ U \in Comp(\mathbb{R})$$

and the initial condition

$$x(0) = x_0.$$

With a transformation of the time we can obtain different finite time horizon optimal control problems. In [1], integral transformations where used to solve the transformed problem numerically. It turned out, that the quality of the numerical results depend even on the choosen transformation.
One difficulty of the transformed problem is, that the new integrand can have singularities. For this reason, the Pontryagin Maximum Principle can not applied directly to the transformed problem. We will discuss the relations between the transformation and the regularity of the control problem. Examples are given to illustrate the results.

References

[1] D. Garg, W. W. Hager, and A. V. Rao, *Pseudospectral Methods for Solving Infinite-Horizon Optimal Control Problems.* Automatica, December 2010.

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