Control Parametrization Enhancing Transform to Optimal Control Problems

K. L. Teo

Department of Applied Mathematics, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong (mateokl@polyu.edu.hk)

Summary. In this talk, we consider a class of constrained optimal control problems subject to canonical constraints. This class of optimal control problem can be solved by using the classical control prameterization technique, where the time horizon is partitioned into several subintervals. The control functions are approximated by piecewise constant functions with pre-fixed switching time points. The heights of these piecewise constant functions are decision variables. However, the accuracy of the approximation depends greatly on the number of switching time points. Thus, the computational cost will be substantial if an accurate solution is to be obtained. Intuitively, the switching time points should also be taken as decision variables. With this motivation, a novel transform, known as the control parametrization enhancing transform, is used to map these variable switching time points into pre-fixed ones. Thus, the approximate optimal control problems with variable switching times are converted into equivalent standard optimal control problems involving piecewise constant functions with pre-fixed switching points. The transformed problems are essentially optimal parameter selection problems and hence are solvable by various existing algorithms. In particular, the optimal control software package, MISER 3.2, is readily applicable. The purpose of this paper is to present the approach and the results obtained in a mathematically rigorous manner. Furthermore, how these optimal parameter selection problems are to be solved as mathematical programming problems will be explained.