

Preface

In this book we study the structure of approximate solutions of optimal control problems considered on subintervals of a real line. We are interested in properties of approximate solutions which are independent of the length of the interval, for all sufficiently large intervals. The results in this book deal with the so-called turnpike property of the optimal control problems. To have this property means, roughly speaking, that the approximate solutions of the problems are determined mainly by the integrand (objective function) and are essentially independent of the choice of interval and endpoint conditions, except in regions close to the endpoints.

Turnpike properties are well known in mathematical economics. The term was first coined by P. Samuelson in 1948 when he showed that an efficient expanding economy would spend most of the time in the vicinity of a balanced equilibrium path (also called von Neumann path). Now it is well known that the turnpike property is a general phenomenon which holds for large classes of variational problems. For these classes of problems, using the Baire category approach, it was shown that the turnpike property holds for a generic (typical) problem.

In this book we generalize this result for a general class of optimal control problems. More precisely, in Chap. 2 of this book we consider a class of optimal control problems (with the same system of differential equations, the same functional constraints, and the same boundary conditions) which is identified with the corresponding complete metric space of objective functions (integrands). The main results of Chap. 2 establish the turnpike property for any element of a set which is a countable intersection of open everywhere dense sets in the space of integrands. This means that the turnpike property holds for most optimal control problems (integrands). In Chap. 3 we study infinite horizon optimal control problems corresponding to the space of integrands introduced in Chap. 2. A class of linear control problems is considered in Chap. 4.

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<http://www.springer.com/978-3-319-01239-1>

Structure of Approximate Solutions of Optimal Control Problems

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2013, VII, 135 p., Softcover

ISBN: 978-3-319-01239-1