

Dynamic Programming Principle

Paul-Emile Galine
Supervisor : Alekos Cecchin

July 21, 2023
11h30 in 2BC30

Abstract

This seminar discusses the Dynamic Programming Principle (DPP), a method developed by Richard Bellman in 1952. The concept is quite straightforward: breaking down a problem into smaller nested subproblems and combining the solutions to reach an overall solution. DPP has found applications in numerous fields, from aerospace engineering to economics and finance.

We will focus our work on control theory, precisely on how we can use DPP to solve stochastic control problems. Our basic approach will be to consider a family of control problems by varying the initial state values and deriving relations between the associated value functions. From this approach, we will derive a certain nonlinear second-order PDE called the Hamilton Jacobi Bellman equation (HJB). If such a PDE can be solved explicitly, we will apply a verification step to check the optimality of this solution.

The goal of this seminar will be to provide you with a powerful approach to solving challenging optimization problems.

References

- [1] Wendell H. Fleming, H.M. Soner (2006). *Controlled Markov Processes and Viscosity Solutions*. Springer New York, NY.
- [2] Huy  n Pham (2009). *Continuous-time Stochastic Control and Optimization with Financial Applications*. Springer Berlin, Heidelberg.
- [3] Martino Bardi (2022). *Notes of the course "Differential Equations"*.