

# Small Data-Driven Algorithms for solving non-linear stochastic equations and non-linear parabolic PDEs

Emmanuel GOBET, Ecole Polytechnique, Palaiseau

**Gang LIU**, Ecole Polytechnique, Palaiseau

**Jorge ZUBELLI**, IMPA, Rio

We aim at solving a dynamic programming equation (inspired from stochastic control problems and semi-linear parabolic PDEs) associated to a Markov chain  $X$ , using a Regression-based Monte Carlo algorithm. We assume specifically that we have access to the model only through  $M$  observations of its paths (called the root sample). Then, we design a non-intrusive stratified resampler (NISR) able to generate suitable learning samples of paths of  $X$ , which are then used to compute the projection of the value function on a functions basis (Regression Monte Carlo).

The resulting scheme can solve the dynamic programming equation (possibly in large dimension) using only a relatively small set of  $M$  root paths. To assess the accuracy of the algorithm, we establish non-asymptotic error estimates.

Applications to stochastic control problems and to reaction-diffusion PDEs in spatially distributed populations are developed.

## Références

- [1] E. GOBET, G. LIU, J. ZUBELLI, *A non-intrusive stratified resampler for regression Monte Carlo: application to solving non-linear equations*, in preparation, 2016.