Probability Seminar

Title: Markov Chains on Borel Standard State Spaces and its Invariant Measures: a Spectral Theory Approach

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Date: 06/15/2018 Time: 2:00pm

Place: Room MAT-A(Miniauditorium)

Abstract: In this lecture we will show how to use the maximal spectral data of a suitable positive operator acting on $C_b(X, \mathbb{R})$ to construct a time-homogeneous Markov Chain on a general Borel standard state space, and also present a new sufficient condition, related to some regularity properties of this operator ensuring the existence of a unique invariant measure. This is based on a series of papers [1, 2, 3, 4], where a generalized version of Perron-Frobenius Theorem in infinite dimensions is developed. We compare the scopes and advantages of, the classical methods based on transition probability kernels [5], and our topological approach. We also explain how the spectral gap property of this positive operator can be used to obtain the so-called limit theorems for Markov Chains such as: the Central Limit Theorem and Strong Law of Larger Numbers. As applications we will present a result on asymptotic stability for Markov operators with respect to the 1-Wasserstein metric, and also discuss, briefly, how to employ our methods to construct diffusions in infinite dimensions [6], intuitively described by the following infinite system of SDE's $dX_t^n = dB_t^n - \langle e_n, \nabla f(\sigma^n(X_t^1, X_t^2, \ldots))\rangle\, dt$.

References

[1] L. Cioletti, M. Denker, A. O. Lopes, and M. Stadlbauer. Spectral properties of the ruelle operator for product-type potentials on shift spaces. *Journal of the London Mathematical Society*, 95(2):684–704, 2017.

[2] L. Cioletti, E. A. Silva, and M. Stadlbauer. Thermodynamic formalism for topological markov chains on borel standard spaces. *Preprint*, p. 1–17, 2018.

[3] L. Cioletti and E. A. Silva. Spectral properties of the Ruelle operator on the Walters class over compact spaces. *Nonlinearity*, 29(8):2253–2278, 2016.

[4] L. Cioletti, A. C. D. van Enter, and R. Ruviaro. The double transpose of the ruelle operator. *ArXiv* e-print:1710.03841, p. 1–19, 2017.

[5] S. Meyn and R. L. Tweedie. *Markov chains and stochastic stability*. Cambridge University Press, Cambridge, second edition, 2009. With a prologue by Peter W. Glynn.

[6] H. Osada. Interacting Brownian motions in infinite dimensions with logarithmic interaction potentials. *Ann. Probab.*, 41(1):1–49, 2013.