

## DISTINGUISHED LECTURE SERIES

# AN INTRODUCTION TO INTERTWINING VIA STRONG STATIONARY DUALITY

Strong stationary times are a 'pure probability' way of proving rates of convergence of Markov chains to their stationary distribution--just by thinking. You can see the randomness emerging. Hidden behind is a duality between two Markov processes, one with a stationary distribution, the other absorbing. When the second is absorbed, the first is mixed! It sometimes seems like a magic trick. This course is an introduction with many examples so that listeners can appreciate the other developments at the conference.



**Persi Diaconis**  
**Mary V. Sunseri Professor of Statistics**  
**Professor of Mathematics**  
**Stanford University**

### LECTURE ONE: FIRST EXAMPLES AND BASIC SETUP (5 Aug)

Markov chains, mixing times, various measures of mixing--total variation, separation and their relation. Shuffling cards--top to random, riffle shuffling and their analysis. The Diaconis-Chung-Graham process. Existence and first properties of Strong stationary times.

### LECTURE TWO: DUALITY AND INTERTWINING (6 Aug)

ALL of the examples we know have the following features: A natural Markov chain is studied by finding a second process embedded in it. When the embedded process hits a certain point, the original process is in stationarity. Can this always be done? What good is this 'duality'. I will introduce basic constructions in a 'hands on' elementary manner, introducing the basic intertwining relation ' $\pi P = \lambda P$ '. This links to other dualities; time reversal and Siegmund duality used before. Various extensions, set and measure valued duals will be described.

Date : 5 - 8 Aug 2024  
Time : 9:30—10.30am  
Venue : IMS Auditorium

Institute for Mathematical Sciences  
3 Prince George's Park  
Singapore 118402

### LECTURE THREE: APPLICATIONS OF DUALITY (7 Aug)

Dual processes can be used to give 'mechanical' constructions of Strong stationary times (no brilliance needed). They offer a stochastic interpretation of the eigenvalues of a Markov chain. I will show how this gave a solution of the Peres conjecture for Birth and Death chains (joint work with Saloff-Coste). Duality offers refinements of the basic bounds via early stopping. All of this illustrated by examples.

### LECTURE FOUR: DEVELOPMENTS AND OPEN PROBLEMS (8 Aug)

Many of the examples where Dual chains can be usefully constructed are for random walk on groups where stationary distributions are uniform. Applications in statistics call for constructions with less symmetry. I will illustrate this using Nestoridi's construction of stationary times for random walks on the chambers of a hyperplane arrangement and through Igor Pak's many examples of non-uniform duals

### Registration

<https://tinyurl.com/IMSIntertwiningReg>



This mini course is part of the program on  
[Intertwining between Probability, Analysis and Statistical Physics](#)

