1137-37-337   **Paul J Hurtado*** (`phurtado@unr.edu`), 1664 North Virginia Street, University of Nevada, Reno/0084, Reno, NV 89509, and **Adam Kirosingh**. *General Proofs and Extensions of the 'Linear Chain Trick' for Reducing Integro-differential Delay Equations to Ordinary Differential Equations.* Preliminary report.

This talk introduces new theory for more easily deriving mean-field ODEs (instead of equivalent integro-differential equations aka distributed delay equations) from continuous time stochastic state-transition models. The Linear Chain Trick (LCT; aka the Gamma Chain Trick) is for reducing integro-differential equations to equivalent ODEs when these are mean-field models of stochastic state transition models with Erlang (Gamma) distributed dwell-times. LCT shortcomings include (1) being limited to Erlang dwell-times, and (2) a lack of general theory to associate stochastic assumptions directly to ODE structure, thus requiring modelers to first derive system-specific integro-differential equations. Our results address both issues by allowing more straightforward applications of the LCT and various extensions to construct mean-field ODEs directly from stochastic model assumptions. Our Generalized Linear Chain Trick framework does this for a broad class of models with flexible dwell time distributions. These results (1) clarify the connections between underlying stochastic assumptions and mean-field ODE models, and (2) allow modelers to move beyond the simple LCT to construct ODE models that more accurately incorporate more realistic non-Erlang distributions. (Received February 06, 2018)