Seventh Workshop Dynamical Systems Applied
to Biology and Natural Sciences DSABNS 2016
Évora, Portugal, February 2-5, 2016

POWER LAW JUMPS AND POWER LAW WAITING TIMES, FRACTIONAL CALCULUS AND HUMAN MOBILITY IN EPIDEMIOLOGICAL SYSTEMS

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ABSTRACT

In human mobility not only power law jumps but also non-exponential waiting times of power law type have been reported to be important, at least in the analysis of surrogate data of such human mobility. More recently much improved algorithms have been developed for power law jump distributions and power law waiting time distributions. We improve the analysis of these methods by avoiding histograms via using less data or simulation hungry ordering methods, similar to what is used e.g. in Kolmogorov-Smirnov tests. Then we investigate these new possibilities to analyse such systems of power laws in jumps and waiting times and its connections with fractional calculus and their potential in analyzing human mobility in application to epidemiology, especially dengue fever epidemiology in Thailand. It turns out that inhomogeneities in population densities already can be used to model human mobility and subsequently epidemiological spreading, e.g. via models mimiking radiation. Such models also present already power laws in their jump distributions, and could be combined with information on waiting times to improve accuracy in describing the dengue fever spreading between provinces in Thailand.

 ISBN: 978-989-98750-2-9