Migration-Contagion Processes

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Résumé

Consider the following migration process based on a closed network of N queues with K_N customers. Each station is a ./M/infty queue with service (or migration) rate mu. Upon departure, a customer is routed independently and uniformly at random to another station. In addition to migration, these customers are subject to an SIS (Susceptible, Infected, Susceptible) dynamics. That is, customers are in one of two states: I for infected, or S for susceptible. Customers can only swap their state either from I to S or from S to I in stations. More precisely, at any station, each susceptible customer becomes infected with the instantaneous rate alpha.Y if there are Y infected customers in the station, whereas each infected customer recovers and becomes susceptible with rate beta. We let N tend to infinity and assume that lim _{N →
infty}K_N/N = eta := lambda/mu, whereηisapositiveconstantrepresentingthecustomerdensity.Themainproblemofin
TheanalysisofthisSISmodelreducestothatofawave−typePDEforwhichwefoundnoexplicitsolution.ThisplainSISmod
DOCS(DepartureOnChangeofState)andtheSIS−AIR(AveragedInfectionRate), whichbothadmitclosedformsolution.
AIRsystemisaclassicalmean−fieldmodelwheretheinfectionmechanismbasedontheactualpopulationofinfectedcustom
formsolution.SIS−DOCSfeaturesacceleratedmigrationinthateachchangeofSISstateimpliesanimmediatedeparture.
typePDEthatadmitsaclosedformsolution.Inthistext, themainfocusisontheclosedsystemsandtheirlimits.Theopensyste
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