On-line parameter estimation method for a stochastic adsorption system at the nano-scale

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This study proposes an on-line parameter estimation method for a stochastic adsorption and desorption process occurring at the nano-scale. Recent advances in system nanotechnology have developed several carbon nanotube-based sensors which can detect single-molecular adsorption dynamics through stochastic quenching of light intensity. For the stochastic data, more mathematical analysis is required for extracting physical information such as the local concentration or flux of the target molecules surrounding the sensors. Our previous study(2013 DYCOPS, accepted)have presented sufficient kinetic Monte Carlo simulation-based evidences showing the optimality of a maximum likelihood estimation(MLE) method using exact probability-density-function (PDF) solution of the chemical master equation(CME). In practical use of nanosensors, the parameter estimation method should provide the physical information within the sampling time. The first and second order moment analysis can be used for designing computational efficient parameter estimation method instead of using exact PDF-based MLE for CME.