KEYNOTE SPEAKER

Statistical Methods in Nano-Material Research: Experimental Design, Modeling and Robustness

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The transition from laboratory-level synthesis of nanostructures to their large scale, controlled and designed synthesis necessarily demands systematic investigation of the manufacturing conditions under which the desired nanostructures are synthesized reproducibly, in large quantity and with controlled morphology. A systematic study on the growth of Cadmium Selenide nanostructures (e.g., nano-wires, rings and belts) through statistical modeling and optimization of the experimental parameters is conducted, with the objective of investigating the best process conditions that ensure synthesis with high yield and reproducibility. Through a designed experiment and statistical analysis of data, models linking the probabilities of obtaining specific morphologies to the process variables are developed. A new iterative algorithm for fitting a multinomial logistic model is proposed and used. The optimum process conditions, which maximize the above probabilities and make the synthesis process robust (i.e., less sensitive) to variations of process variables around set values, are derived from the fitted models. Current research focuses on developing a novel sequential and space-filling design strategy, dubbed "minimal energy algorithm", to address the problem of economically optimizing a very complex and non-regular response surface containing several no-yield regions. Preliminary work on the exciting new invention of the first ever nanogenerators (by Professor Z. L. Wang at GT, a collaborator of the speaker) will also be presented.
This is based on joint work with T. Dasgupta (Harvard) and R. Joseph (George Tech).

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