**On a Sampling Decision System using Virtual Metrology**

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In semiconductor manufacturing, metrology operations are so expensive and time-consuming that only a certain number of wafers are measured. For that reason, one is interested in developing Virtual Metrology (VM) methodologies predicting wafer fine metrology results in real-time and free of costs. However, currently used sampling designs do not take account of such information. In that context, a sampling decision system (SDS) is presented that relies on virtual metrology data suggesting an optimal strategy for measuring productive wafers. Considering control charts within a decision-theoretical framework, the expected value of measurement information is computed by means of Monte Carlo (MC) integration; this is a way to assess the informational gain resulting from a measurement. Optimal sampling decisions are obtained using a two-stage decision model. Extensions of the SDS consider bad wafer quality risk and fixed real metrology operations by cumulating past decision risks. A Bayesian conjugate Wishart model allows to update uncertainty of virtual measurements whenever a real measurement is available. The sampling decision system is extended to a set of virtual and real metrology data from the semiconductor industry. Wafer measurements are only performed when really needed.