Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Incorporating Gradient Information for Uncertainty Quantification using Response Surface Methods JOHANN DAHM, COLIN MIRANDA, KRZYSZTOF FIDKOWSKI, KENNETH POWELL, The University of Michigan — Response surfaces provide a nonintrusive framework for quantifying the effects of uncertainties in the inputs on resulting computational outputs. Using gradient information can in turn provide substantially improved representations of the response surface, which may enable significant computational savings. Here we assess various ways that gradient information based on discrete adjoints can be used to obtain such computational efficiencies within the context of a radiation hydrodynamics simulation. These include interpolation-based schemes as well as predictor-based schemes. Additionally, we examine effects of the discretization level used in representing the response surface, both by changing the spatial discretization directly and by increasing the sparseness of the basis set used to represent the surface. Results show that among the interpolation schemes examined, piecewise cubic interpolants usually provide the best combination of accuracy and computational efficiency. In general, predictor-based schemes impose substantially greater computational loads than do interpolation-based schemes having similar levels of accuracy. Regarding sparse basis representations of the surface, the choice of retained basis elements can significantly affect the resulting computational efficiency. This work is supported by DOE DE-FC52-08NA28616.

Johann Dahm
The University of Michigan

Date submitted: 21 Jul 2011 Electronic form version 1.4