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Adjoint-Based UQ And Optimization Under Uncertainty For Satellite Shield Designs

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Several common UQ algorithms rely exclusively on computed quantities of interest, e.g. stress or pressure, to generate uncertainty information about a design. Some algorithms can exploit gradients of those quantities of interest as well, provided gradient information is available. In the case of the linear Boltzmann transport equation we can use a combination of forward and adjoint calculations to inexpensively generate such gradients. In our work we demonstrate the application of adjoint-based sensitivities to the question of satellite electron and/or proton shield design, where dose to a part is constrained. We use this both for UQ of a fixed design as well as for optimization of such designs while accounting for uncertainties. These approaches are shown to be more computationally efficient than non-gradient-based methods.

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