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An Adjoint Method to Calculate Magnetic Island Width Sensitivity ALESSANDRO GERALDINI, MATT LANDREMAN, University of Maryland, College Park, ELIZABETH PAUL, Princeton Plasma Physics Laboratory — To improve confinement, stellarators are designed to have the smallest possible magnetic islands. However, unavoidable errors in the positioning of the coils during construction cause small perturbations to the intended magnetic field configuration. If the size of an island is too sensitive to such perturbations, the tolerance on the coil positioning may be lower than the expected construction error, and large islands can appear in the device. In NCSX the increase in construction cost, which led to the cancellation of the experiment, was in part due to low coil tolerances associated with island size (Neilson et al, 2010). We describe an efficient method to quantify island width sensitivity that could be used in the early stages of stellarator design. The island width is calculated by following a single field line corresponding to the island centre (Cary Hanson, 1991). An adjoint method is used to efficiently compute and verify the gradient of island widths with respect to a single parameter for a simple class of magnetic field configurations (Reiman Greenside, 1986) where the size of an island and its gradient are known analytically. The method is then applied to the calculation of the shape gradient of island widths with respect to coils in configurations such as NCSX.

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