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Application of adjoint methods for stellarator geometry sensitivity using REGCOIL ELIZABETH PAUL, MATT LANDREMAN, WILLIAM DORLAND, University of Maryland — A significant challenge to the feasibility of the stellarator is the design of simple coils which allow for diagnostic access and optimal physics properties. REGCOIL [Landreman, Nucl. Fusion 57 (2017) 046003] employs a Tikhonov regularization approach to compute the current potential on a specified coil winding surface given a desired plasma surface. An objective function, which includes the normal magnetic field on the plasma surface and the squared current density, is minimized by solving a single linear system. This method achieves lower surface-integrated and maximum current potential and normal magnetic field and allows for greater control over the level of regularization than the NESCOIL method. We extend the REGCOIL approach by computing sensitivity of the objective function with respect to coil geometry parameters. We apply an adjoint method, a common technique for shape optimization problems in aerodynamics, allowing the gradients with respect to a large number of control parameters to be computed rapidly. We compute the sensitivity by analytically differentiating the objective function. This extended REGCOIL approach can be applied within an optimization iteration to obtain coil surfaces which better reproduce the desired plasma shape and maximize coil-coil separation.

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