Status of the PIES 3D Equilibrium Code[1] A. REIMAN, D. MON-
TICELLO, D. RABURN, S. LAZERSON, Princeton Plasma Physics Laboratory —
PIES is a 3D, free-boundary, equilibrium code that can handle islands and stochastic
regions. We discuss the present status of the code, focusing particularly on improve-
ments that have been made over the last few years. The code has been modified
to provide two additional options for convergence algorithms: 1) a Jacobian-Free
Newton-Krylov (JFNK) algorithm, with an adaptive preconditioner, globalized by a
subspace restricted backtracking scheme [1]; 2) a full Newton algorithm, appropriate
for massively parallel computation. An adaptive grid for calculating the current has
also been implemented in recent years, providing a more accurate treatment of the
physically important currents near the island separatrices, and of neoclassical effects
on tearing modes. In addition, a theory of equilibria in stochastic regions has been
developed, and a version of the corresponding algorithm has been implemented in
the PIES code [2]. This has been motivated by indications in contemporary stel-
larator experiments that there are large stochastic regions with significant nonzero
pressure gradients.

[1] D. Raburn, Ph.D. Thesis, Princeton University, 2011.
[2] A. Reiman, M. Zarnstorff, D. Monticello, et al, Nucl. Fusion 47, 572-578 (2007);
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A. Reiman
Princeton Plasma Physics Laboratory

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