

Outline

- 1 Island reduction / coil healing method as of PVR
- 2 Problems with method
- 3 Dynamical healing
- 4 Dynamical healing iteration

Island reduction / coil healing method

- 1 Free boundary PIES calculations enables determination of the magnetic field structure of a given equilibrium with a given coil set.
- 2 An island reduction method was based on PIES by considering the resonant fields, after a fixed number N of PIES iterations, to be function of the coils.
- 3 No changes were made to the coils during the PIES calculation.
- 4 The coil geometry was varied to eliminate the resonant fields using a Newton method.
- 5 This method enabled the resonant fields to be significantly reduced up to N iterations.

Problems with method

- 1 However, this method provided no guarantee that as the PIES iterations continued that the resonant fields at the selected surfaces will remain zero.
- 2 Extended PIES convergence tests indicated that 'healed' configurations may or may not maintain good magnetic surfaces.
- 3 The suggested explanation for this is that non-linear evolution and coupling of higher order modes may destroy the surfaces.
- 4 Though some success with this method was achieved, a more reliable method is required.

Dynamical Healing

- 1 Dynamical healing, which makes small changes to a given coil set at each PIES iteration, is presently under consideration.
- 2 Changes will be made to the coil set to cancel resonant components of the plasma field.
- 3 It is hoped that this method will enable coil sets that result in plasma configurations with good surfaces at an arbitrary number of PIES iterations, and thus lead directly to converged solutions with good surfaces.
- 4 Of course, the changes to the coils must approach zero as the iterations continue.
- 5 A detailed algorithm of the dynamical healing is presented.
- 6 Note that PIES is an equilibrium code and terms such as dynamical, evolution etc. refer strictly to the PIES iterations and not to how the plasma changes with time.

Definitions

\mathbf{B}_P is the plasma field;

\mathbf{B}_C is the coil field;

\mathbf{x} is the coil geometry;

$\nabla \mathbf{B}_{Cnm}$ is the coupling matrix relating changes in the resonant components of the coil magnetic field at selected rational surfaces to changes in the coil geometry;

α is the PIES blend parameter;

n represents the PIES iteration index.

PIES / healing iteration

