Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

A family of analytic equilibrium solutions for the Grad-Shafranov equation. LUCA GUAZZOTTO, JEFFREY FREIDBERG, Massachusetts Institute of Technology — In toroidal systems, such as the tokamak, magnetohydrodynamic equilibria are routinely described by means of the well known Grad-Shafranov (GS) equation. Analytic solutions of the equation are few and far between, and equilibria are normally determined with the help of numerical tools. Even though equilibrium codes are nowadays very reliable, it is still worthwhile to investigate the existence of analytic solutions of the GS equation, because (1) such equilibria are very useful in providing benchmark cases to test existing codes, (2) analytic solutions provide a good model to test for stability without having to worry about accuracy and resolution issues arising from numerically computed equilibria. In this work, we present a technique to solve the GS equation for special, but realistic, profiles of the two free functions of magnetic flux. Our solution allows us to retain arbitrary plasma elongation and triangularity, arbitrary aspect ratio, and arbitrary beta, while setting the edge current and pressure gradient to zero. We show that realistic equilibria for standard (e.g. ITER, C-MOD) and spherical (e.g. NSTX) tokamaks can be obtained with our technique.

Luca Guazzotto
Massachusetts Institute of Technology

Date submitted: 19 Jul 2007 Electronic form version 1.4