

OPEN AND EMERGING CONTROL PROBLEMS IN TOKAMAK PLASMA CONTROL

M. L. Walker, E. Schuster, D. Mazon, and D. Moreau

ABSTRACT

The tokamak concept for magnetic confinement of fusion plasmas is now quite mature scientifically. This maturity is evidenced by the ongoing worldwide effort to design and construct an internationally supported multi-billion dollar experimental tokamak called ITER, whose purpose is to demonstrate the scientific and technical feasibility of fusion energy as a power source. To achieve its scientific objectives, the ITER device will need to implement solutions to several challenging control problems. Some solutions to these control problems are already mature, e.g. control of the plasma boundary shape and stabilization of the vertical stability, but many other solutions are currently in development or do not yet have viable solution approaches. In almost all cases, control solutions developed on existing tokamaks are made more challenging on ITER by safety issues arising from its nuclear mission and control actuation margins that are reduced due to cost considerations. However, many of these problems must have robust solutions in place before ITER comes online in approximately 2016. In this paper, we summarize a set of the most urgently needed control solutions and describe the progress made toward solving a few of these problems.