Plasma Current Ramp-up Phase Simulation of ITER

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The plasma current ramp-up phase of ITER reference scenario 2 [1] is simulated using a tokamak discharge simulator which consists of a free-boundary evolution code, DINA-CH and an advanced transport modelling code, CRONOS [2]. In the current ramp-up phase of the reference inductive 15MA scenario, the plasma which is initially limited at the outboard expands following the plasma current and density ramp-up until the plasma has a fully diverted shape. Then, the plasma current reaches its maximum value at the end of the current ramp-up phase with an active plasma shape control. Plasma density is assumed to increase linearly and effective charge decrease monotonically as the density increase. Heat transport is assumed to follow an ohmic energy confinement scaling law. The evolution of plasma current, position and shape is calculated self-consistently with PF-coil current evolution and electro-magnetic response to the surrounding conducting tokamak system. In the early phase of the current ramp-up with a limited plasma shape, besides the vertical position and plasma current controllers, a virtual radial position controller is applied to stabilize the plasma. The set of PF coil currents required for the current ramp-up scenario would be assessed in this work.

References

[1] ITER Design Description Documents, N 11 DDD 178 04-06-04 R 0.4