New pedestal temperature models with self-consistency calculation of safety factor and magnetic shear

T. Onjun[1], T. Siriburanon[1], and O. Onjun[2]
[1] *Sirindhorn International Institute of Technology, Thammasat University, Klongluang, Pathumthani, Thailand*
[2] *Department of Science Service, Bangkok, Thailand*

E-mail: thawatchai@siit.tu.ac.th

New predictive pedestal models are developed for the temperature at the top at the pedestal of H-mode plasmas. Theory-motivated models are used for the pedestal width and pressure gradient. Three pedestal width models — based on magnetic shear and flow shear stabilization, flow shear stabilization, and normalized poloidal pressure — are used in this study. The pedestal pressure gradient is assumed to be limited by infinite *n* ballooning mode instability, in which effects of both first and second stability of ballooning modes are included. These new pedestal models are implemented in the 1.5D BALDUR integrated predictive modeling code, where the safety factor and magnetic shear can be solved self-consistency. With the self-consistency approach for calculating safety factor and magnetic shear, the effect of bootstrap current can be included properly and, consequently, access second stability regime of ballooning mode can be obtained. This new integrated modeling protocol of the BALDUR code is used to predict the temperature and density profiles of 33 H-mode discharges. The pedestal model is used to provide the boundary conditions in the simulations, once the heating power rises above the H-mode power threshold. Simulations are carried out for 20 discharges in the Joint European Torus and 13 discharges in the DIII-D tokamak. These discharges include systematic scans in normalized gyroradius, plasma pressure, collisionality, isotope mass, elongation, heating power, and plasma density.