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Simulation of Neoclassical Tearing Modes in JET

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In this work, a simulation of neoclassical tearing mode (NTM) in JET experiments is considered using a 1.5D BALDUR integrated predictive modeling code with an improved ISLAND. An original ISLAND module [1] for calculating the saturated width of magnetic island caused by a magnetic reconnection is obtained from the NTCC Library [2]. This ISLAND module is then modified to improve a consistency and reliability of island width prediction. The modified ISLAND module is still based on Rutherford equation [3] and quasi-linear theory approach. With the improved ISLAND module integrated in 1.5D BALDUR, the effects of neoclassical tearing modes (NTM) can be considered. The effect of NTM is described using the model that both thermal and particle transport within the magnetic island is enhanced, resulting on the flattening of profiles within that region. The BALDUR code with a modified ISLAND module is then used to carry out the time evolution of plasma current, temperature, and density profiles, where the effects of NTM can be real time considered. For example, in JET discharge No. 33131, the simulations with magnetic islands mode (2,1), or with magnetic island mode (3,2), or with both magnetic island mode (2,1) together with mode (3,2), are carried out. It is found that when the magnetic island mode (2,1) is considered, the ion and electron temperature profile, and also the total stored energy profile are decreased the most comparing to the other two scenarios.

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