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VDEs investigation of the negative triangularity tokamak plasmas

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Abstract

The negative triangularity plasmas are considered to be of important significance on the favorable capability of the power handling towards the fusion reactors [1]. For better understanding the VDEs characteristic of the negative triangularity plasma, a negative triangularity tokamak model, symmetric with the newly designed medium-sized copper-conductor machine HL-2M [2], is created in this paper. The VDEs, of the double-null negative triangularity configurations in such model, is compared to that of the corresponding positive triangularity configuration in HL-2M, by the DINA code [3,4]. Result analysis shows that, the negative triangularity tokamak plasma keeps some certain VDEs characteristics, e. g. the halo current, as well as the electromagnetic loads on the vacuum vessel, of the hot VDE is larger than that of the major disruption with the cold VDE. Meanwhile, some unique characteristics are observed. Compared to the corresponding positive triangularity plasmas, for the major disruption case of the negative triangularity plasmas, two peaks are generated in the evolution waveform of the halo current. Furthermore, the electromagnetic loads on the vacuum vessel become much higher. During the hot VDE, the negative triangularity plasmas become more unstable in the vertical direction, which will cause more challenge for the feedback control. Whilst, the halo current, as well as the electromagnetic loads on the vacuum vessel, becomes more severe during the current quench (FIG. 1), which is unfavorable for the engineering design.

References

[1] Medvedev S.Y. *et al* 2015 *Nucl. Fusion* **55** 063013
[2] Zheng G.Y. *et al* 2014 *Fusion Eng. Des.* **89** 2621
[3] Khayrutdinov R R and Lukash V E 1993 J. Comput. Phys 109 193
[4] Lukash V et al 2005 Plasma Devices Oper. 13 143
[5] Lukash V.E. and Khayrutdinov R.R. 1996 Plasma Phys. Rep. 22 91

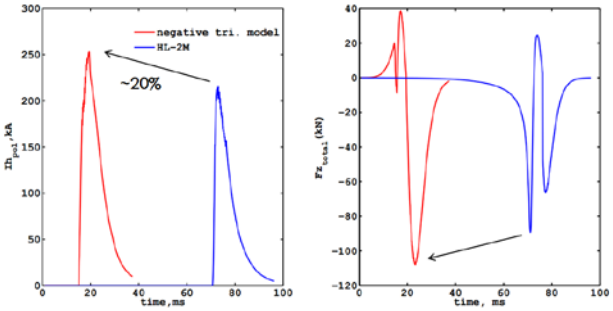

Figure 1. EM loads comparison between the standard and the negative triangularity configuration during the VDE.