Contribution ID: **92** Type: **Oral**

Identification of MHD modes on EAST using a deep learning framework

Thursday, 18 July 2024 11:20 (20 minutes)

In Tokamak plasma, The instability of magnetohydrodynamic(MHD) severely limits the improvement of plasma parameters and may even lead to plasma disruption events, thereby threatening the safety of device components. The identification of MHD modes is crucial for the study and control of MHD instabilities.
Traditional MHD mode recognition methods mostly use the raw information of diagnostic signals for correlation calculation and analysis. The efficiency of building a large MHD mode database by manually identifying MHD mode information is relatively low. A data-driven neural network can discover correlations between data and efficiently process large-scale datasets. Therefore, using artificial intelligence methods to identify the three common MHD modes in EAST and building an MHD database in EAST is of great significance for statistical research on MHD modes in EAST.
In EAST experiments, there are three common MHD modes. 2/1 tearing mode, 3/2 tearing mode, and 1/1 fish-bone mode. The diagnostic signals which MIRNOV and soft X-rays signals are commonly used for MHD analysis. Based on the output results of the diagnostic signals, typical plasma discharge shots including three different MHD modes are selected to build an MHD mode recognition data set. Two kinds of machine learning algorithm experiments were conducted based on the MHD data set. Firstly, an MHD classification model was built based on BP neural network, and sample shots were selected for training and testing. An average accuracy of 91.16% was achieved on the test set. The test results shows that the BP network is effective for 2/1 and 3/2 tear mode, but is not very good for fish-bone mode. Afterwards, another optimized MHD mode recognizer was developed based on time convolutional network and long short-term memory network. We name the recognizer "Temporal Convolutional Hybrid network Recognizer MHD， TCHI-MHD". The tested results of TCHI-MHD are better than BP network after sample training. An average accuracy of 98.38% on the test set. In addition, the recognizer was expanded to analyze MHD frequency and amplitude. A preliminary EAST MHD database was built base on the TCHI-MHD.

Speaker's Affiliation

Institute of Plasma Physics, Chinese Academy of Sciences, Hefei, P.R.CHINA

Member State or IGO

China, People's Republic of

Primary author: Prof. SHEN, biao (Institute of plasma physics, Chinese Academy of Sciences)

Co-author: Ms KONG, lingyi (Institute of plasma physics, Chinese Academy of Sciences)

Presenter: Prof. SHEN, biao (Institute of plasma physics, Chinese Academy of Sciences)

Session Classification: Machine Learning

Track Classification: Machine Learning