

Time series methods for fusion plasma disruption prediction

Tuesday 9 September 2025 11:15 (25 minutes)

The approaching initial operation of major new tokomaks is rendering more pressing the need for effective disruption prediction techniques. The required tools should be not only accurate but also capable of operating with a minimum number of signals, because in the first campaigns of new devices typically only a very limited number of diagnostics is available. In addition, a very limited number of examples and extremely unbalanced sets of cases will make the problem even more difficult. These are very unfavorable conditions for the training of traditional machine learning classifiers. Therefore, approaches based on the identification of dynamical changes in the time series corresponding to routinely available diagnostic signals (locked mode, plasma current) has been developed recently. These methods are based on the identification of chaos onset, detection of concept drifts, changes in the complexity of the time series represented by ordinal patterns. The methods are capable of detecting the plasma drifting towards dangerous regions of the operational space in real time with high accuracy.

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Session Classification: Signal Processing and Anomaly Detection

Track Classification: Signal Processing and Anomaly Detection