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Realtime tokamak simulation with a first-principle-based neural network turbulent transport model

Thursday, 20 October 2016 14:00 (4h 45m)

A realtime capable core turbulence tokamak transport model is developed, extending a previous proof-of-principle (J.Citrin, S.Breton et al., Nucl. Fusion 55 092001, 2015). This model emulates a quasilinear gyrokinetic turbulent transport code, via regularized nonlinear regression using neural networks. Calculation of transport fluxes for the entire radial profile is achieved at sub-millisecond timescales. Experimental validation is presented, including
ion and electron heat transport, and particle transport. The unprecedented combination of computational speed and relative modelling accuracy provided by these methods opens up enormous potential for controller design, controller validation, discharge supervision, offline operational scenario development, and trajectory optimization using model-based predictive control techniques.

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Primary author: Dr CITRIN, Jonathan (FOM DIFFER - Dutch Institute for Fundamental Energy Research)

Co-authors: Dr BAIOCCHI, Benedetta (Istituto di Fisica del Plasma "P. Caldirola"); Dr FELICI, Federico (Eindhoven University of Technology); Dr IMBEAUX, Frédéric (CEA-IRFM); Mr REDONDO, Juan (IRFM, CEA); Ms BRETON, Sarah (IRFM, CEA); Dr ANIEL, Thierry (IRFM, CEA); Mr CAMENEN, Yann (CNRS); Mrs BOURDELLE, clarisse (CEA, IRFM, F-13108 Saint-Paul-lez-Durance, France.)

Presenter: Dr CITRIN, Jonathan (FOM DIFFER - Dutch Institute for Fundamental Energy Research)

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