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postdoc position 2011

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Title : Integrated Modelling of coupled core transport equations and free boundary Equilibrium in Tokamaks

Summary :

. The coupling of core transport equation solvers with free boundary equilibrium codes is challenging both from the numerical and scientific point of view. Its main application is to predict the dynamics of the plasma core profiles consistently with those of the plasma shape and of the currents in tokamak coils and conducting structures. As a practical application, it allows verifying that the poloidal field coil supplies and shape control algorithm can cope with a given plasma scenario. In addition, the movement of the plasma boundary can be determined in relation with e.g. transient phenomena occurring in the core plasma, allowing quantifying requests for margins in plasma operation. In summary, such a simulation allows, if validated, to check the feasibility of a plasma scenario from practical tokamak operational constraints. This is quite important in view of the preparation of experiment on ITER.
In the past years, CEA/IRFM (Institute for Magnetic Fusion Research) has developed the CRONOS Integrated Modelling code, which is essentially dealing with most aspects of core transport. Recently, CRONOS was coupled to free boundary equilibrium codes, DINA and FREEBIE. The coupling to another free boundary code, CEDRES++, is ongoing. The CRONOS team now has a significant experience in such coupled core transport + free boundary simulation and we are offering a post-doctorate position, limited to a two years contract, in view of supporting and exploiting the recent developments in this field.
For the first year, the work should cover:

- Exploitation of the coupled CRONOS-FREEBIE simulator both for ITER scenarios and for validation against experimental data (TCV, Tore Supra, JET)
- Finalisation of the CRONOS-CEDRES++ coupling and its verification and validation

For the second year, the work will extend to passing the validated codes and learned experience onto the European Integrated Modelling platform developed by the European Task Force on Integrated Tokamak Modelling (ITM-TF). A CRONOS-like prototype, the European Transport Solver (ETS) has been developed already on this platform though is far less mature than CRONOS yet. The work will consist in learning the principles of modern workflow design used on the ITM-TF platform and transferring the CRONOS algorithms and some of the physics modules on this platform, building up on the existing ETS prototype. Verification and a limited exploitation of the developed workflow will conclude the 2 years work.
In summary, this post-doctorate position offers an opportunity to develop, exploit and validate challenging integrated modelling workflows in modern environments, with applications both to ITER scenarios and comparison to experimental data.