Transient deterministic modeling of neutral gas flow in DEMO particle exhaust system

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Abstract

In the present work, the transient response of the DEMO (DEMOnstration Fusion Power Plant) particle exhaust system is investigated in a wide range of the operating conditions. The transient behavior of the neutral gas flows is studied on the basis of the numerical solution of the unsteady kinetic models of the Boltzmann equation using the Discrete Velocity Method (DVM). The time of the neutral gas flow establishment is studied as a function of the initial divertor conditions as well as the pumping capability of the vacuum pumps. In addition, the effect of the intermolecular interaction law on the transient distributions of the neutrals gas flow quantities is also investigated. Moreover, special attention is paid in the applied different parallelization strategies which are compared in terms of the computational efficiency. The results show that the applied deterministic methodology allows a computationally efficient transient study of the neutral gas dynamics in the particle exhaust of the fusion reactors using nowadays High Performance Computing (HPC) centers.