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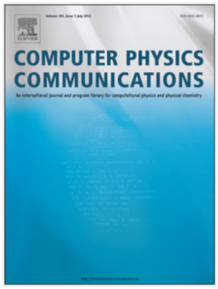

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Block-Structured Grids for Eulerian Gyrokinetic Simulations

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Abstract

In order to predict the turbulent transport in magnetic fusion experiments, global (i.e., full-torus) gyrokinetic simulations are often carried out. In this context, one frequently encounters situations in which the plasma temperature varies by large factors across the radial simulation domain. In grid-based Eulerian codes, this enforces the use of a very large number of grid points in the two-dimensional velocity space, and, thus, an enormous computational effort. To minimize the computational requirements, one may employ block-structured grids, adapted to the radial changes of the temperature. As the block-structured grids rely on a general approach, they can be applied to different Eulerian gyrokinetic implementations. In this paper, we explain the construction and implementation of such grids in the gyrokinetic code GENE, F. Jenko et al. (2000), and present corresponding simulation results.

Keywords: Plasma turbulence, gyrokinetic simulation, block-structured grids

1. Introduction

Plasma microturbulence is responsible for causing strong outward transport of heat and particles in fusion experiments, making a thorough understanding of it of paramount importance to the development of future nuclear fusion reactors. Gyrokinetics has been shown to be an appropriate model to simulate microturbulence in magnetically confined core plasmas [1, 2]. In spite of a reduction from six to five dimensions and a removal of irrelevant space-time scales compared to the full kinetic description, gyrokinetic simulations are still computationally expensive. For example, an estimated grid for the future large-scale

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