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On Vertically Global, Horizontally Local Models for Astrophysical Disks

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The shearing box has been extensively used for studying local processes in accretion disks. This framework is appropriate for studying barotropic disks, for which the pressure is only a function of the density and the angular frequency is independent of height. I will introduce a more general framework by showing that, given a global disk model, it is possible to develop consistent models that are local in horizontal planes and global in height with shearing-periodic boundary conditions. These models can be non-axisymmetric for globally barotropic disks but should be axisymmetric for globally baroclinic disks. I will illustrate the potential of this new framework with two prominent applications, namely the vertical shear instability and the magnetorotational instability. I will discuss the prospects of using this new framework to study a wide variety of astrophysical phenomena.

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