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Separation and Sorting of Heavy Particles Suspended in a Fluid by Settling in a Periodic Vorticity Field

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Processes involving separation and sorting of small particles from fluids are important in the environment and many industrial processes. For particles which density is much greater that the fluid density we have simulated a velocity field generated by a 2D array of vortices periodically repeated in space. Firstly the neighbouring vortices were swirling alternatively cyclonically and anticyclonicaly. For small particle inertia the particles follow the flow streamlines surrounding the vortices, but for larger particle inertia the particles settle in the central region of low flow vorticity situated between two vertical rows of vortices due to an inertial bias. Secondly all the vortices were swirling anticyclonically. Surprisingly, for sufficiently great particle inertia some isolated curves appear, which limit some regions of low vorticity where particles can not enter and all the particles settle on those curves. As greater is the particle inertia greater is the width of those regions. Therefore if we know the particle inertia we will know the position in which it will settle and vice versa, so this fact suggest a mechanism to sort particles with different inertia values materializing the velocity field mentioned above.

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