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Quantum Modeling in Simulation of Turbulent Flows[1] YOSEF TIRAT-GEFEN, Castel Research Inc. & George Mason University — Major atmospheric events can be modeled by turbulent flows. We provide a brief introduction to the mathematical fundamentals of turbulence and fluid dynamics, and discuss the possible use of modeling techniques borrowed from quantum mechanics. This work deals with an isotropic homogeneous flow, which allows us to study the turbulence phenomena in a more simplified way. We represent the Navier-Stokes equations modeling fluctuations for such a type of flow by applying the Fourier transform to each term, leading to space-time representation of the flow. We trace a parallel of such representation to ones found in quantum systems. We revisit the gas lattice automata model introduced in 1973 by Hardy, de Pazzis and Pomeau, and investigate how to implement it in highly parallel fine-grain machines, such as state-of-the-art supercomputers supporting reconfigurable processors and the future quantum computers. Unlike the probabilistic partial differential equation (PPDE) models used in traditional turbulent flow theory, there is no need of complex calculations or integrations as the flow is modeled as an assembly of cells and particles.

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