Wavelet-based Multiresolution Particle Methods MICHAEL
BERGDORF, ETH Zurich, PETROS KOUMOUTSAKOS, ETH Zurich — Particle
methods offer a robust numerical tool for solving transport problems across disci-
plines, such as fluid dynamics, quantitative biology or computer graphics. Their
strength lies in their stability, as they do not discretize the convection operator,
and appealing numerical properties, such as small dissipation and dispersion er-
rors. Many problems of interest are inherently multiscale, and their efficient solu-
tion requires either multiscale modeling approaches or spatially adaptive numerical
schemes. We present a hybrid particle method that employs a multiresolution anal-
ysis to identify and adapt to small scales in the solution. The method combines
the versatility and efficiency of grid-based Wavelet collocation methods while re-
taining the numerical properties and stability of particle methods. The accuracy
and efficiency of this method is then assessed for transport and interface capturing
problems in two and three dimensions, illustrating the capabilities and limitations
of our approach.

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