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Denoising PIC Codes to Approach the Performance of Vlasov Codes[1] BEDROS AFEYAN, KIRK WON, VLAD SAVCHENKO, Polymath Research Inc., JEAN LUC STARCK, CEA, Saclay Astrophysique, STEVE ROSENTHAL, THOMAS MELHORN, Sandia National Laboratory, DALE WELCH, ATK Mission Research, VIKTOR DECYK, UCLA, KEN STRUVE, Sandia National Laboratory — We use multiresolution analysis and wavelet techniques in order to reduce the random noise in PIC simulations caused by subsampling phase space. We compare the performance of two different sets of wavedlet based denoising schemes one of which is specifically designed for few sample point Poisson noise (between 10 and 30 particles per cell). The techniques are applied in both active and passive modes. In the passive case, we gain insight on the nature and amount of noise that accumulates in an ordinary PIC run by post processing. While with active denoising, we reduce this noise in real time during the simulation without allowing to accumulate. The examples used to gauge the benefits of the methods are the bump on tail instability and KEEN waves. [1]

[1] B. Afeyan et al., Proc. IFSA (Inertial Fusion Sciences and Applications 2003, Monterey, CA), 213, B. Hammel, D. Meyerhofer, J. Meyer-ter-Vehn and H. Azechi, editors, American Nuclear Society, 2004.

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