Pair dispersion toolbox

Thomas Basset

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1 Why to use it?

For a given set of tracks, this MATLAB toolbox enables to compute pair dispersion statistics for positions and velocities.

2 How to use it?

As an example, we use the file *tracks_sample.mat* available in the HDF5 storage toolbox (cf. *readme_hdf5_storage*). Once the distances $\Delta(t)$ and the velocity differences $\Delta v(t)$ for all pairs are computed, we can compute $\langle(\Delta(t)-\Delta_0)^2)\rangle = S_2(\Delta_0)t^2$ with Δ_0 the initial separation (first order approximation). Because $S_2(\Delta_0) = \frac{11}{3}C_2(\varepsilon\Delta_0)^{2/3}$ with $C_2 \simeq 2$ in homogeneous isotropic turbulence, we can extract ε ($\varepsilon \simeq 0.9\,\mathrm{W/kg}$). For the velocities, we can compute the autocorrelation function for $\Delta v(t)$ and extract the integral time scale T then the parameter α defined as $\alpha = T/T_0$ with $T_0 = S_2(\Delta_0)/2\varepsilon$ (cf. Bourgoin *JFM* 2015 dedicated to pair dispersion for more details, this α problem is under investigation). The script *run_pair_dispersion* gives a run example.

3 Functions

help function name gives some documentation, especially input and output arguments. These functions are commented and designed to be easily modified.

- *lagstats_onetrack*: compute Lagrangian statistics for one track
- *lagstats_tracks*: compute Lagrangian statistics for all tracks with *lagstats_onetrack* and compute the mean over the tracks with *meancell*
- *meancell*: compute the mean of array cells of different lengths
- *pairdisp_proc*: compute $\Delta(t)$ and $\Delta v(t)$ for all pairs
- *pairdisp_stats_d*: compute $\langle(\Delta(t)-\Delta_0)^2)\rangle$ for a given range of Δ_0
- *pairdisp_stats_v*: compute $\langle\Delta v(t+\tau)\Delta v(t)\rangle$ for a given range of Δ_0