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The multiparametric statistical analysis of hydrodynamic instabilities, based on wavelet preprocessing and neuronetwork classification

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The present work demonstrates a new method of studying the RT-instability, which is based on the analysis and generalisation of a large amount of numerically simulated data. Initially these data (for different sets of initial conditions: hereinafter - processes) had been organised into time series of 2D distributions of physical values. Discrete wavelet-transform of these distributions has led to stable (in time) representation, namely to one, for which the proximity of states for early time moments (i.e. proximity by Euclidean distance between wavelet-images) is followed by proximity of late states of the processes. This feature of wavelet-representation allows one to perform probabilistic prediction of the Rayleigh-Taylor mixing evolution in time by comparison of an initial state with ones of the processes picked from database.

The analysis of DNS results, which have been visualised in the space of wavelet-components, discovered two important characteristics of the processes, which depend linearly on coefficients of wavelet-decomposed density fields. First of these characteristics correlates with "age" (time of evolution) of a process, mixed mass, mixing zone width, *etc.* Second one depends on time weakly, and its presence indicates that motion integrals are likely to exist for the problem of RT-induced mixing.

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