



A model for boundary layer based on attractor representation

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This work is devoted to computer modeling of aerodynamic flows into the boundary layers [1] with usage of nonlinear dynamics methods in the state-space (phase space)[2],[3].Instability of flow appears in boundary layer of concave wall, when the velocity of external flow (e.g. and Reynolds number) tends to certain value. The main statement of this work is the following:perturbations are similar to the Hertler whirlwinds [1],their axes are directed along basic flow vector. Taking into account this suppositions this report shows how the system of partial differential equations (describing aerodynamic processes in the boundary layers) is reduced to the system of ordinary differential equations based on the Galerkin's method.Then the fractal-topological characteristics of attractor of this system are investigated.The main aim of this approach is to derive a new attractor describing the dynamical behaviour of aerohydrodynamic processes in a boundary layer.The computer simulation of air flows into the boundary layers is carried out by means of program system STAR-CD [4]. According to this second (computational) approach,the obtained time series of the component velocity, and pressure are proceed into the pseudo-phase space. The reconstructed attractors are investigated by means of estimations of their fractal-topological characteristics (the minimal attractor embedding dimension,Lyapunov exponents etc.).The obtained results of analysis in accord with the first and the second approaches are compared with each other. References: [1] H. Schlichting, Grenzschicht-Theorie. Verlag G Braun, Karlsruhe,1970. [2] A.M. Krot, Nonlinear Phenomena in Complex Systems, vol. 4, N2, 2001, pp. 106-115. [3] A.M. Krot and H.B. Minervina, Nonlinear Phenomena in Complex Systems,vol.5, N2, 2002, pp.161-172. [4] Methodology for STAR-CD:Version 3.15A(©2002 Computational Dynamics Limited).