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Classification and transitions of streamline topologies of structurally stable incompressible flows[1] TAKASHI SAKAJO, Kyoto University, TOMOO YOKOYAMA, Kyoto Univ. of Education — We consider Hamiltonian vector fields with a dipole singularity satisfying the slip boundary condition in two-dimensional multiply connected domains. An example of such Hamiltonian vector fields is an incompressible and inviscid flow in exterior multiply connected domains with a uniform flow, whose Hamiltonian is called the stream function. Here, we are concerned with streamline topologies of incompressible fluid flows, which are the level sets of the Hamiltonian. We first provide a classification procedure to assign a unique sequence of words, called the maximal words, to every structurally stable streamline pattern. Owing to this procedure, we can identify every streamline pattern with its representing sequence of words up to topological equivalence. In addition, based on the theory of word representations, we propose a combinatorial method to provide a list of possible transient structurally unstable streamline patterns between two different structurally stable patterns by simply comparing their maximal word representations without specifying any Hamiltonian. It reveals the existence of many non-trivial global transitions in a generic sense. We also demonstrate how the present theory is applied to fluid flow problems with vortex flows.

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