A new approach to the L^p-theory of $-\Delta + b \cdot \nabla$, and its applications to Feller processes with general drifts

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Abstract. We develop a detailed regularity theory of $-\Delta + b \cdot \nabla$ in $L^p(\mathbb{R}^d)$, for a wide class of vector fields. The L^p-theory allows us to construct associated strong Feller process in $C_\infty(\mathbb{R}^d)$. Our starting object is an operator-valued function, which, we prove, determines the resolvent of an operator realization of $-\Delta + b \cdot \nabla$, the generator of a holomorphic C_0-semigroup on $L^p(\mathbb{R}^d)$. Then the very form of the operator-valued function yields crucial information about smoothness of the domain of the generator.