Linear Property in R^n

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Abstract: The paper characterizes all hypersurfaces $\Gamma \subset R^n$ which have the the property that for all functions which are harmonic in $R^n \setminus \Gamma$, lie in $\mathcal{C}^\infty(\overline{\otimes})$ for each $\Omega \subset R^n \setminus \Gamma$ and have the same normal derivative on each side of Γ the tangential components of derivative add up to 0 in each point of Γ. It is shown that in R^2 the set Γ can only be a subset of a circle or a subset of a straight line. For $n \geq 3$ the only sets $\Gamma \subset R^n$ are contained in a hyperplane. For Γ with this property is the problem of the flow of an ideal fluid through the porous Γ linear, otherwise is the problem strongly non-linear. The approach is to use a standard double layer ansatz over the set Γ and to derive from the condition on the tangential derivatives a local condition, from which then the above results follow by standard geometric considerations.