Meeting: 1001, Evanston, Illinois, SS 6A, Special Session on Nonlinear Partial Differential Equations and Applications

1001-35-41 **Guozhen Lu** (gzlu@math.wayne.edu), Department of Mathematics, Wayne State University, Detroit, MI 48202, and **Biao Ou*** (bou@math.utoledo.edu), Department of Mathematics, University of Toledo, Toledo, OH 43606. *A Poincare inequality on R^n and its application to potential fluid flows.*

Consider a function $u(x)$ in the standard localized Sobolev space $W^{1,p}_{loc}(R^n)$ where $n \geq 2$, $1 \leq p < n$. Suppose that the gradient of $u(x)$ is globally L^p integrable; i.e., $\int_{R^n} |\nabla u|^p dx$ is finite. We prove a Poincaré inequality for $u(x)$ over the entire space R^n. Using this inequality we prove that the function subtracting a certain constant is in the space $W_0^{1,p}(R^n)$, which is the completion of $C_0^\infty(R^n)$ functions under the norm $||\phi|| = (\int_{R^n} |\nabla \phi|^p dx)^{1/p}$ where $\phi \in C_0^\infty(R^n)$. As a result, we come to know the best constant and the optimizing functions for the Poincaré inequality on R^n.

We then prove a similar inequality for functions whose higher order derivatives are L^p integrable on R^n.

Next we study functions whose gradients are L^p integrable on an exterior domain of R^n and apply the results to another proof of an existence theorem for irrotational and incompressible flows around a body in space. (Received July 13, 2004)