1014-76-470 **Pangyen Weng*** (pweng@ramapo.edu), Tamarack A, 505 Ramapo Valley Rd., Ramapo College of New Jersey, Mahwah, NJ 07430. *On Sobolev Spaces of Divergence-Free Vector Fields.* Preliminary report.

We consider the equivalence of two Sobolev spaces of divergence-free vector fields in open bounded domains. Define the following terms:

- Energy norm $\|\cdot\|$:
$$\|\mathbf{u}\| = \left\{ \sum_i \int_\Omega |\nabla u_i|^2 \, d\mathbf{x} \right\}^{1/2}.$$
- $\mathbf{D}(\Omega) = (\mathcal{C}_0^\infty(\Omega))^d$.
- $\mathcal{V} = \{\mathbf{u} \in \mathbf{D}(\Omega) : \operatorname{div} \mathbf{u} = 0\}$.
- $V(\Omega) =$ the closure of $\mathcal{V}$ in $\|\cdot\|$.
- $\tilde{V}(\Omega) = \{\mathbf{u} \in \mathbf{W}_0 : \operatorname{div} \mathbf{u} = 0\}$, $\mathbf{W}_0$ is the closure of $\mathbf{D}(\Omega)$ in $\|\cdot\|$.

We prove that $V(\Omega) = \tilde{V}(\Omega)$ in $\mathbb{R}^2$. We then generalize the results to open, bounded, and axisymmetric domains in $\mathbb{R}^3$. The key to these results is a theorem on Sobolev spaces by Hedberg, the technique of stream functions, and the topological structure of $\mathbb{R}^2$. (Received September 16, 2005)