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Radial and block-radial subspaces of Sobolev and Besov spaces: regularity, decay and compactness

The relation between the regularity of functions that satisfied some symmetry conditions, e.g. the radial functions, and their decay at infinity was noticed in late 60-ties of the last century by people working in PDE. In particular W.Strauss proved the following inequality:

$$|x|^{\frac{n}{2}-1}|f(x)| \leq \|\nabla f\|_2, \quad f \in \dot{W}_2^1(\mathbb{R}^n),$$

where f is a radial function on \mathbb{R}^n , $n > 2$. This inequality implies the compactness of some Sobolev embeddings of inhomogeneous Sobolev spaces of radial functions. This is related to the fact that the lack of compactness of the usual Sobolev embeddings is related to the action of a group of isometries of corresponding function space.

One can also consider the weaker symmetry conditions e.g the multi-radial (block-radial) functions. We present the results proved with W.Sickel (Jena) and C.Tintarev (Uppsala) related to Strauss' inequality for more general classes of functions and symmetry conditions.