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Lecture notes Sobolev
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Johanna Penteker

Institute of Analysis

Johannes Kepler

University Linz These

lecture notes are a

revised and extended

version of the lecture

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notes written by
Roman Strabler and
Veronika Pillwein
according to a lecture
given by Paul F. X.
Muller

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MAT201C Lecture

Notes: Introduction to
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Shkoller Department of
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Davis, CA 95616 USA
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ucdavis.edu May 26,
2011 These notes,
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MAT201C Lecture Notes: Introduction to Sobolev Spaces

Notes on Sobolev
Spaces Peter Lindqvist
Norwegian University
of Science and
Technology 1 Lp-
SPACES 1.1 Inequalities
For any measurable

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function $u: A \rightarrow [-\infty, \infty]$,

$A \in \mathbb{R}^n$, we define $\|u\|_p$

$= \|u\|_p, A = \int_A |u(x)|^p$

dx and, if this quantity

is finite, we say that $u \in$

$L^p(A)$. In most cases of int

erest $p \geq 1$. For $p = \infty$

we set $\|u\|_\infty = \|u\|_\infty, A$

$= \text{ess sup}_{x \in A} |u(x)|$.

The essential

supremum is the ...

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440 BRUCE K. DRIVER†
 $\|u_n - v_n\|_{W^{k,p}(\Omega)} \leq C/2^{n+1}$ for all n . Let $v := \sum_{n=1}^{\infty} v_n$, then $v \in C^{\infty}(\Omega)$ because the sum is locally finite. Since $X_{\infty} = \sum_{n=0}^{\infty} \|u_n - v_n\|_{W^{k,p}(\Omega)} \leq \sum_{n=0}^{\infty} C/2^{n+1} = C < \infty$, the

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$\sum_{n=0}^{\infty} (u_n - v_n)$
converges in $W^{k,p}(\Omega)$. The sum, $\sum_{n=0}^{\infty} (u_n - v_n)$, also converges pointwise to $u - v$ and hence $u - v = \sum_{n=0}^{\infty} (u_n - v_n)$ is in $W^{k,p}(\Omega)$. Therefore $v \in W^{k,p}(\Omega) \cap C^\infty(\Omega)$ and

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a similar course entitled Sobolev spaces and calculus of variations in Helsinki. The subject was similar, so it was not possible to avoid overlapping. However, the overlapping is little. I estimate it as 25%. While preparing the notes I used partially

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the notes that I prepared for the previous course. Moreover Lectures 9 and 10 are based on the text

Sobolev spaces, theory and applications

Sobolev Spaces have become an indispensable tool in the theory of partial differential equations and all graduate-level courses on PDE's ought

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to devote some time to the study of the more important properties of these spaces. The object of these notes is to give a self-contained and brief treatment of the important properties of Sobolev spaces.

AN INTRODUCTION TO SOBOLEV SPACES

1.1. LECTURE ONE:

SOBOLEV SPACES 7

1.1.4 Sobolev spaces

by existence of weak

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derivatives. If $f \in L^p$ has a weak derivative g then on the subset of functions which have a weak derivative we can define the first Sobolev norm as $\|f\|_{W^{1,p}} = \|f\|_{L^p} + \|g\|_{L^p}$. The Sobolev Space could then be defined as the set of weakly differentiable functions.

**IMUS Lecture Notes
on Harmonic
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Spaces and ...**

Page 15/26

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Warning: This is a first draft of the lecture notes and should be used with care! 1.

Sobolev spaces and Sobolev embeddings

Definition 1.1. The homogeneous Sobolev space $H_{-s}(\mathbb{R}^n)$ is the completion of $C_1^{\infty}(\mathbb{R}^n)$ under the norm $\|f\|_{H_{-s}} := \| |j|^s \hat{f} \|_{L^2(\mathbb{R}^n)}$:

(1.1) Similarly, the inhomogeneous Sobolev space $H^s(\mathbb{R}^n)$ is the completion of $C_1^{\infty}(\mathbb{R}^n)$

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**ADVANCED PDE II -
LECTURE 5 (PART 1)**

Motivation 1.12

(Sobolev spaces and PDEs). Clearly the Sobolev spaces are nested, i.e., $W^m(\Omega) \subseteq W^{m-1}(\Omega)$, and the identity map $\text{id} : W^m(\Omega) \rightarrow W^{m-1}(\Omega)$ is continuous [since the norm on W^{m-1} can be estimated by $\| \cdot \|_{W^m}$]. In applications the following two results are of great

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importance: Sobolev
embedding theorem:
For $f \in W^m(\Omega)$ and m
 $> k + n$

Fourier Transform & Sobolev Spaces

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self-contained
monograph collecting
all the basic properties
of variable exponent
Lebesgue and Sobolev
spaces is timely and
provides a much-

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needed accessible
reference work utilizing
consistent notation and
terminology.

**Lebesgue and
Sobolev Spaces with
Variable Exponents |
Lars ...**

"This book is based on
a set of lecture notes
prepared by the author
from a graduate course
... . The main themes
are Sobolev spaces
and interpolation
theory. ... The book

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contains 42 chapters,
each intended to
contain the amount of
material which would
be suitable for a
graduate lecture. ...

**An Introduction to
Sobolev Spaces and
Interpolation Spaces**

...

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Assignments Download

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lecture notes were

prepared by two

former students in the

class. Zuoqin Wang

prepared lecture notes

0 through 11 in LaTeX,

and Yanir Rubinstein ...

Sobolev Spaces : 18:

Sobolev Imbedding

Theorem $p < n$

Morrey's Inequality :

19:

Lecture Notes |

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Differential Analysis

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MIT

Lecture 18 April 22nd,
2004 Embedding
Theorems for Sobolev
spaces Sobolev
Embedding Theorem.

Let Ω a bounded
domain in \mathbb{R}^n , and $1 \leq$
 $p < \infty$. $W^{1,p}_0(\Omega) \subseteq L^p(\Omega)$

$W^{1,p}(\Omega) \subseteq L^q(\Omega)$, $q = \frac{np}{n-p}$, $p < n$
 $C^{0,\alpha}(\Omega)$, $\alpha = 1 - \frac{n}{p}$, $p > n$, i.e in particular \subseteq

$C^0(\Omega)$. Furthermore,
those embeddings are
continuous in the

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following sense: there exists $C(n,p,\Omega)$ such

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Sobolev spaces In this chapter we begin our study of Sobolev spaces. The Sobolev space is a vector space of functions that have weak derivatives.

Motivation for studying these spaces is that solutions of partial differential equations, when they exist,

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belong naturally to
Sobolev spaces.
1.1 Weak derivatives
Notation.

JUHA KINNUNEN
Sobolev spaces -
Aalto

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Spaces | A. Visintin |
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