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This course presents a unified approach to extending boundary data from rough
domains into the interior, with a focus on applications to boundary value
problems for elliptic operators. We study recent advances in constructing
\emph{smooth harmonic-type extensions} of BMO and \( L^p \) functions from the
boundary \( \partial \Omega \) of a domain \( \Omega \subset \mathbb{R}^{n+1}
\), where the geometry of \( \Omega \) may be highly irregular.

The domains under consideration include:
\begin{itemize}
    \item \textbf{Corkscrew domains}  when \( \partial \Omega \) is \( n \)-
dimensional and Ahlfors regular,
    \item and \textbf{complements of \( s \)-Ahlfors regular sets} when \( s < n
\).
\end{itemize}

The core objectives of the course include:
\begin{itemize}
    \item Constructing \emph{smooth interior extensions} of boundary functions
with optimal control in terms of \emph{Carleson measures} and \emph{non-
tangential maximal functions},
    \item Establishing \emph{pointwise convergence} of these extensions back to
the boundary data in a non-tangential sense,
    \item Showing how \emph{Lipschitz boundary data} yields Lipschitz continuous
extensions up to the closure of the domain.
\end{itemize}

A significant portion of the course will be dedicated to \textbf{applications in
elliptic boundary value problems}, particularly for \emph{divergence-form
elliptic systems with rough (e.g., merely bounded, complex-valued)
coefficients}. We will explore:
\begin{itemize}
    \item The role of these extensions in solving \emph{Dirichlet problems with
\( L^p \) and BMO boundary data},
    \item Connections between \emph{interior regularity in Carleson or tent
spaces} and the \emph{solvability of Poisson problems},
    \item How these tools fit into the modern framework of harmonic analysis on
non-smooth domains.
\end{itemize}

The course is aimed at graduate students and researchers interested in
\emph{elliptic PDEs, harmonic analysis, and geometric measure theory}. It will
balance theoretical development with motivation from concrete problems in
analysis and PDE.
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