

# Partial Differential Equations Seminar

**Title** Existence of weak solutions for incompressible generalized Newtonian fluid: Lipschitz truncation

**Speaker** 고승찬 박사

**Affiliation** The University of Hong Kong

**Date** June 14<sup>th</sup> 2022, 14:00 ~ 15:00

**Location** 과학관 254

## Abstract

In fluid dynamics, the motion of incompressible fluids is described by the system of partial differential equations consists of the the conservation of mass and the conservation of momentum. In order to describe a particular fluid in this framework, we need a constitutive law relating the stress tensor to the symmetric velocity gradient. The most famous example is when the relationship is linear. In this case the system becomes the classical Navier–Stokes equations whose mathematical study is of independent interest. In order to accurately model the motion of fluids with more complicated structure, one needs to consider generalized Newtonian fluid flow models, where the viscosity is assumed to be a function of the shear-rate. The rigorous mathematical study of power-law fluids began in the late nineteen sixties with the pioneering works of Lions and Ladyzhenskaya, respectively. They developed the existence theory of weak solutions with the aid of monotone operator theory. Since then there has been significant progress in the mathematical theory of generalized Newtonian fluids and those early results were extended by using the so-called  $L^\infty$  and Lipschitz truncation techniques, thus establishing the existence of weak solutions with mild assumptions. In this talk, I will introduce the existence theory of the generalized Newtonian fluid flow model. In particular, we will study properties of Lipschitz truncations of Sobolev functions with constant and variable exponent. As non-trivial applications we use the Lipschitz truncations to provide a simplified proof of an existence result for incompressible power-law like fluids, possibly with variable nonlinearity.