WRIGHT STATE UNIVERSITY | DEPARTMENT OF MATHEMATICS AND STATISTICS

# COLLOQUIUM

**Speaker:** **Dr. Alex Alekseenko, Department of Mathematics, California State University, Northridge**

**Title:** **Making Deterministic Solvers for the Kinetic Boltzmann Equation More Efficient**

**Date:** **Friday, September 22, 2017**

**Room/Time:**

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| **Meet-n-Greet:** | **2:30 p.m.** | **Room 222 MM** |
| **Talk:** | **3:00 p.m.** | **Room 224 MM** |

**Host:** **Dr. Mohamed Sulman**

## ABSTRACT:

The Boltzmann equation is believed to provide most accurate description of gas on microscopic scale and provides theoretical underpinning to description of gas at the macroscopic level. Many recent applications of aerospace and miniature technologies introduce processes that span ranges of scales from macroscopic to microscopic. For such applications, Boltzmann equation provides a unified description. Development of methods for solving the Boltzmann equation numerically for complex geometries and in multiple dimensions can help us understand fundamental processes in non-continuum gases, from flows in small channels to high speed high altitude turbulence. At the same time, efficient high-fidelity solution of the Boltzmann equation proved out to be difficult to achieve. The difficulties are the high dimensionality of the equation, the prohibitive costs to evaluate the collision operator describing interaction of molecules, and considerable lack of efficient surrogate models to provide accurate physical representation in regimes of strong non-continuum. However, in recent years the mathematical and engineering community made significant progress toward understanding this problem. In this talk we will discuss various approaches to develop efficient solution of the Boltzmann equation, including the Fourier spectral methods and methods based on discontinuous Galerkin discretizations. Although the subject is very large and technical, all attempts will be made to limit the discussion to highlighting the main ideas and to keep it admissible to graduate students.

## SPEAKER BIO:

Dr. Alekseenko's work is in the area of numerical solution of partial differential and integral equations. He obtained his Ph.D. in Applied Mathematics from Novosibirsk State University in 1999 in inverse problems of magneto-electrodynamics under supervision of Dr. Kabanikhin. His postdoctoral studies were at Penn State and University of Minnesota in numerical general relativity under supervision of Dr. Arnold. In 2003, he joined the faculty at California State University Northridge where he currently works on the development of fast scalable deterministic solutions of the Boltzmann equation. He actively collaborates with AFRL on solutions of rarefied gas dynamics. In 2011-13 he was an NRC Research Associate at AFRL at Wright-Patterson AFB and he was an AF Summer Fellow on multiple occasions.