WRIGHT STATE UNIVERSITY

DEPARTMENT OF MATHEMATICS AND STATISTICS

COLLOQUIUM

Speaker: **Dr. José A. Camberos, Ph. D., P. E., Multidisciplinary Science & Technology Center, U. S. Air Force Research Laboratory, Wright-Patterson AFB**

Title: **Computational Experiments with Direct Simulation Quasi-Random Monte Carlo**

Date: **January 20, 2012**

Room/Time:

Refreshments:	**2:30 p.m.**	**Room: 222 MM**
Talk:	**3:00 p.m.**	**Room: 224 MM**

Host: **Dr. Munsup Seoh**

ABSTRACT:

In kinetic theory, equations derived express a desired quantity in terms of a probability density. The solution to these equations often requires computational techniques. For example, the Direct Simulation Monte Carlo (DSMC) method is a well-known powerful technique for computational rarefied gas dynamics. DSMC uses an algorithm that evolves an initial distribution in time using random sampling. The sampling is achieved classically through the use of a pseudo-random number generator. Quasi-Monte Carlo methods (QMCMs) replace calls to a pseudo-random number generator by calls to a quasi-random number generator. QMCMs are known to have better convergence rates than Monte Carlo methods for high-dimensional integration, but it is not trivial to make QMCM work well in contexts outside of Monte Carlo integration, such as DSMC. In fact, naïve replacement of calls to a pseudo-random number generator by calls to a quasi-random generator has been known to fail utterly. We will illustrate these difficulties and discuss how to overcome them. In the context of DSMC, we tested the method on several benchmark test problems and concluded that little could be gained through use of quasi-random sequences. However in the context of "direct methods" we find promising results.

ABOUT THE SPEAKER:

Dr. José Camberos is a native of Mexico, raised in Southern California. He earned his B. S. degree in mechanical & materials science & engineering from the University of California at Berkeley. He continued his education at Stanford University and earned his M. S. degree in Aerospace Engineering and a Ph.D. in the same field. In 1992, he joined the Flight Dynamics Directorate under the Air Force Senior Knight Program which supported his doctoral thesis work. He joined the Computational Sciences Center in 1999, and is currently is a member of the Multidisciplinary Science & Technology Center, advancing the state-of-the-art for multidisciplinary computational methods based on generalizing and exploiting the second-law of thermodynamics to quantify total system performance.