

# PURDUE MECHANICAL ENGINEERING



## 2016 HAWKINS MEMORIAL LECTURE

**Suhas V. Patankar**

Professor Emeritus, ME, University of Minnesota  
President, Innovative Research, Inc.

September 22, 2016

4:30pm, ME 1061

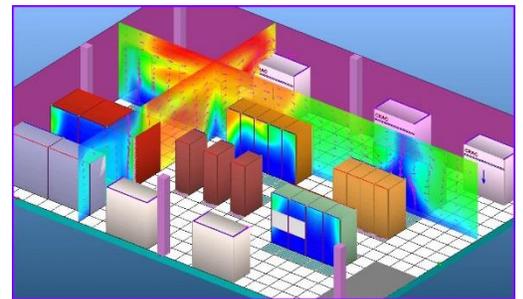
## When Computers Get Hot The Cooling Problem in Data Centers

### Abstract:

Data centers, where thousands of very powerful computers are placed, have become an essential part of any modern business. These computers generate a significant amount of heat and must be properly cooled for their uninterrupted operation. With a variety of complex layouts of data centers and ever-increasing heat loads, it is a major challenge to ensure that all computers are adequately cooled. Also, there is a renewed emphasis on using minimum amount of energy to provide the required cooling.

Rather than performing costly and time-consuming trial-and-error, we can use computational simulation to address this problem. We can build a computer model of the data center and calculate the complete distribution of airflow and temperature in it. Such a simulation allows us to assess the effectiveness of cooling, examine proposed changes in the layout, perform “what-if” studies, evaluate new cooling strategies, and optimize the cooling. The simulation results also enhance our understanding of the flow and temperature patterns and guide us towards improved designs.

The lecture will describe the concept of a data center, outline its cooling design, and show the effect of important design parameters. A number of interesting case studies will be shown via pictorial representations of airflow and cooling. Finally, the results of the computational simulation will be compared with measurements performed in real-life data centers.



### Bio:

Dr. Suhas V. Patankar is a Professor Emeritus in the Mechanical Engineering Department at the University of Minnesota, where he worked for 25 years (from 1975-2000). He is also the President of Innovative Research, Inc. He has done significant research in the field of computational fluid dynamics. Dr. Patankar has authored or co-authored four books, published over 150 papers, advised 35 completed Ph.D. theses, and lectured extensively in the USA and abroad.

Dr. Patankar received his Ph. D. from Imperial College, London. Prior to working at the University of Minnesota, he held teaching and research positions at IIT, Kanpur, Imperial College, and University of Waterloo. For excellence in teaching, he received the 1983 George Taylor Distinguished Teaching Award and the 1989-90 Morse-Alumni Award for Outstanding Contributions to Undergraduate Education. For his research contributions to computational heat transfer, he was given the 1991 ASME Heat Transfer Memorial Award and the 1997 Classic Paper Award. He was awarded the 2008 Max Jakob Award, which is considered to be the highest international honor in the field of heat transfer. In 2015, an International Conference on Computational Heat Transfer (CHT-15) held at Rutgers University in New Jersey was dedicated to Professor Patankar.

Dr. Patankar’s widespread influence on research and engineering education has been recognized in many ways. In 2007, the Editors of the International Journal of Heat and Mass Transfer wrote, “There is no person who has made a more profound and enduring impact on the theory and practice of numerical simulation in mechanical engineering than Professor Patankar.”

*Student Poster Session & Reception @ 3:30 p.m. – Mechanical Engineering Building, Atrium*

# GRADUATE SEMINAR SERIES: ME 691