

**(1) Name:** Raouf A. Ibrahim

**(2) Title:** Professor

**(3) Affiliation:** Mechanical Engineering at Wayne State University, MI, USA

**(4) Short Biography:**

Raouf A. Ibrahim received his BSc (Bachelor of Science) and MSc (Master of Science) in Aeronautical Engineering in 1963 and '69, respectively, from Cairo University. He received his PhD in Mechanical Engineering from the University of Edinburgh in 1974. In 1979, he moved to the United States and joined Texas Tech University as Assistant, Associate, and then full Professors. While at Texas Tech, he was a recipient of Outstanding Professor Award in Teaching in 1982, two Halliburton Awards of Excellence in 1983 and '86, and Texas Tech Presidential Award in Research in 1987. In the same year, he joined Wayne State University and continued his research activities in nonlinear random vibrations, liquid sloshing dynamics, friction-induced vibrations, flutter of aeroelastic structures, vibro-impact dynamics, reliability of naval ships in random seas, and health monitoring of ship composite structures.

In 1994 he was named the Arthur Carr Professor of Engineering, and in 1995 he was awarded the Board of Governors Outstanding Professor Award, and in 2006 he was honored with WSU Faculty Recognition Award. He was named a member of the Wayne State University Academy of Scholars in 2008. He has published over 120 papers in the refereed journals, and three technical books, entitled *Parametric Random Vibration* (Wiley, 1985), *Liquid Sloshing Dynamics* (Cambridge University Press, 2005), and *Vibro-Impact Dynamics* (Springer-Verlag, Berlin, 2009). He is a Fellow of the ASME and the International Center of Vibro-Impact Systems. He has been Associate Editors of *Nonlinear Dynamics*, and *Probabilistic Engineering Mechanics*. He served as Associate Editors for *ASME Applied Mechanics Reviews*, *ASME Journal of Vibration and Acoustics*, and *Journal of Vibration and Control*.

**(5) Subject and Schedule of the Lectures:**

As a part of the subject "Nonlinear Vibration Theory" in the department of Mechanical Systems Engineering, Institution of Engineering, Professor Ibrahim gave the master course students the interesting topics as follows:

May 13 (Mon), 2013

10:30-12:00 Introduction to nonlinear vibrations by showing some examples of nonlinear systems and the role of nonlinear vibration in the design of mechanical systems. The main differences between linear and nonlinear vibrations were highlighted and supported by Videos on linear vibration and disc brake squeal.

12:50-14:20 Vibro-Impact dynamics including power law phenomenological modeling, Zhuravlev's non-smooth coordinate transformation, Hertzian contact and point-wise mapping.

14:35-16:05 Nonlinear modeling using Newton's second law, Lagrange's equation and Hamilton's principle as well as Galerkin's method. Some homework assignments were given to the students to make sure that they comprehend the lectures.

May 14 (Tue), 2013

10:30-12:00 Analytical approaches including averaging method.

12:50-14:20 Struble's method and harmonic balance method.

14:35-16:05 By using harmonic balance method, the solutions of forced oscillations for a Duffing's oscillator and their stabilities were shown, and the behavior of period doubling and chaotic vibrations were explained.

May 15 (Wed), 2013

10:30-12:00 Showing videos concerning the inverted pendulum stabilized without feedback control, and the method of multiple time scales.

12:50-14:20 Bifurcation analysis and structural stability by showing the frequency response curves, phase portraits and generic differential equations for fold, saddle-node, transcritical and pitchfork bifurcation points.

**(6) Comments:**

The students worked-out the assignments to their best abilities, and their performances were more than satisfactory. The students were very quiet and did not ask questions during the lectures. The reason may be attributed to the language barrier.

