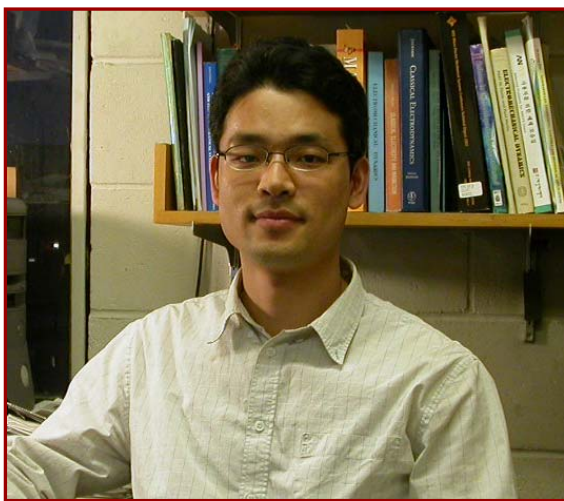


**THURSDAY
OCTOBER 7, 2004**

**Scaife Hall Auditorium
Room 125**

**4:00 PM
Refreshments—3:30 PM**



Se-Hee Lee

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Dr. Se-Hee Lee was born on August 3rd in the year 1971 in a town called Yechon, Kyungbuk, Korea. He completed his BS and MS in the field of Electrical Engineering from Soongsil University, Seoul, Korea in 1996 and in 1998 respectively. For his outstanding undergraduate academic record, he was awarded with a scholarship from Soongsil University for the period 1993 to 1994. He received his PhD in Electrical Engineering from Sungkyunkwan University, in 2002.

He came to Massachusetts Institute of Technology (MIT) in November 2003 as a postdoctoral fellow with a fellowship provided by Korea Science and Engineering Foundation (KOSEF).

During his graduate years in Sungkyunkwan University, he was involved with many projects as a principal researcher involving design and analysis of electromechanical systems. He has performed an extensive amount of research on numerical analysis and optimization of electromechanical systems. His main research interests lie in Continuum Electromechanics, Electromechanical coupled problems, and on MEMS.

During his leisure period, he spends time with his family. He also loves walking and fishing.

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For more information:
<http://www.ece.cmu.edu/seminar>

ANALYSIS OF ELECTROMAGNETIC FORCE DENSITY, ELECTROMECHANICAL COUPLED PROBLEMS, AND BEHAVIOR OF MAGNETIC FLUIDS

Ferrofluids are stable colloidal suspensions of single-domain magnetic particles, coated with a surfactant and are immersed in a carrier fluid, typically oil and water. The particles are commonly composed of magnetite and are about 10 nm in diameter. For the past several years, ferrofluids have remained the subject of increased scientific interest in the field of nanotechnology because of their minute size; however, it is still necessary to conduct extensive amounts of research on ferrofluids in situations where they are subjected to external alternating and rotating magnetic fields. Although many new uses of ferrofluids have been proposed in areas, such as in biomedical devices and in manipulating nanomaterials, only a few of the proposals have met with wide-scale implementation. Despite this, today ferrofluids are successfully utilized in the traditional applications of liquid seals, dampers, and heat transfer agents. To increase our knowledge on the behavior of ferrofluids, some theories and experiments that have been undertaken will be presented.

In electromagnetic systems, the mechanical deformation causes unwanted problems such as vibration and noise. To evaluate the mechanical deformation, we should know not the total force but the distributions of the electromagnetic force density. Mechanical deformation in incompressible linear and nonlinear magnetic materials was evaluated using various electromagnetic force density methods, such as the Maxwell stress tensor method (MX), Korteweg-Helmholtz force density method (KH), magnetic charge method (MC), magnetizing current method (CM), and Kelvin force density method (KV). These force density methods generated similar total force even though the force density distributions are different from one another. Taking the KH, MC, and KV in incompressible material to be theoretically equivalent, the MC, KV, and KH are alternative methods for evaluating the mechanical deformation using the Finite Element Method. For total force, it is strongly related to the mechanical motion of mechanical systems. To this date, a time-stepping method using an electromagnetic field solver, such as finite element method (FEM) or boundary element method (BEM), etc., has been widely used to analyze these moving systems; however, because the system matrix must be solved at each time step, this time-stepping method consumes too much solving time. To solve these problems, a fast solving technique of using the extracted circuit parameters and electro-mechanical coupled state equations will be presented.