KAIST at a Glance

Prof. Jae-Hung Han (Dept. Aerospace)

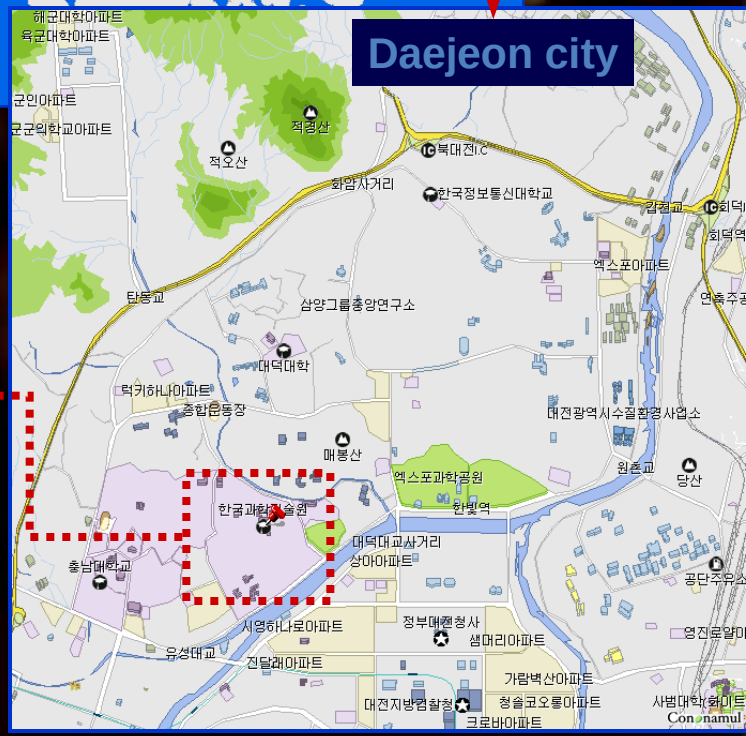
November, 2008

Brief History

- *Feb. 16, 1971 Establishment of Korea Advanced Institute of Science (KAIS) at Seoul campus (graduate school)*
- *Aug. 20, 1975 First graduation of KAIS master's program*
- *Aug. 19, 1978 First graduation of Ph.D. program*
- *Jan. 05, 1981 Establishment of Korea Advanced Institute of Science and Technology (KAIST), merge with KIST*
- *Dec. 31, 1984 Establishment of Korea Institute of Technology (KIT), (undergraduate school)*
- *Jun. 12, 1989 Separation of KIST from KAIST*
- *Jul. 04, 1989 Merge with KIT and transfer to Daedeok campus*
- *Dec. 17, 1990 First graduation of bachelor's program*
- *Jan. 19, 1996 Establishment of Graduate School of Management*
- *May 04, 2004 Establishment of National NanoFab Center*
- *Oct. 1, 2006- Nov. 15, 2007 Establishment of 8 KAIST research institutes*
- *May 31, 2008 KAIST-ICU(Information & Communications Univ.) merger plan is announced*

Where?

Daejeon city



KAIST

Dept. of Aerospace Eng.

Scenery of KAIST

Goal

To make KAIST

one of the best Science and Technology

Universities

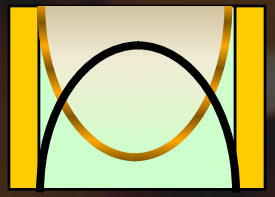
in the World

Strategies

Education

Design / Synthesis
Bilingual
Dual degree program

Research



EEWS
KI for Research Excellence
Research at the interface

Operation

Dept.-Centric system
Boundary-Less system
Ethics

Cooperation

Globalization
Interaction with the Int'l Community
Contribution to the society

Distinctive Features of KAIST

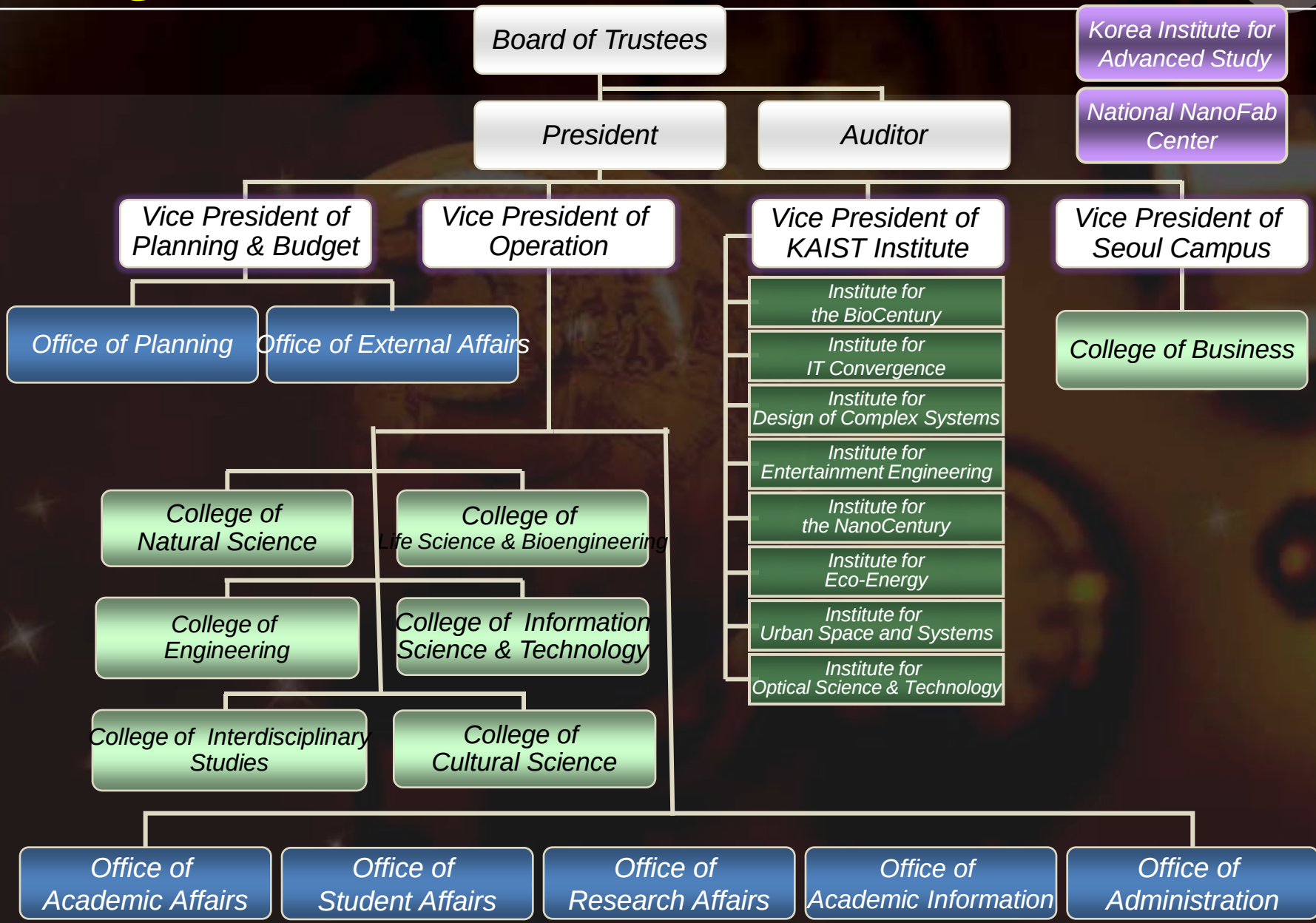
- ***Unique Status in Korea***
  - *Public institution under **MOST***
  - ***Scholarship granted to all students with G.P.A. above 3.0***

- ***Flexible Management of Academic Affairs***
  - *Independent & flexible management granted by **KAIST Law***
  - *Early admission of students who completed their junior year of high school*

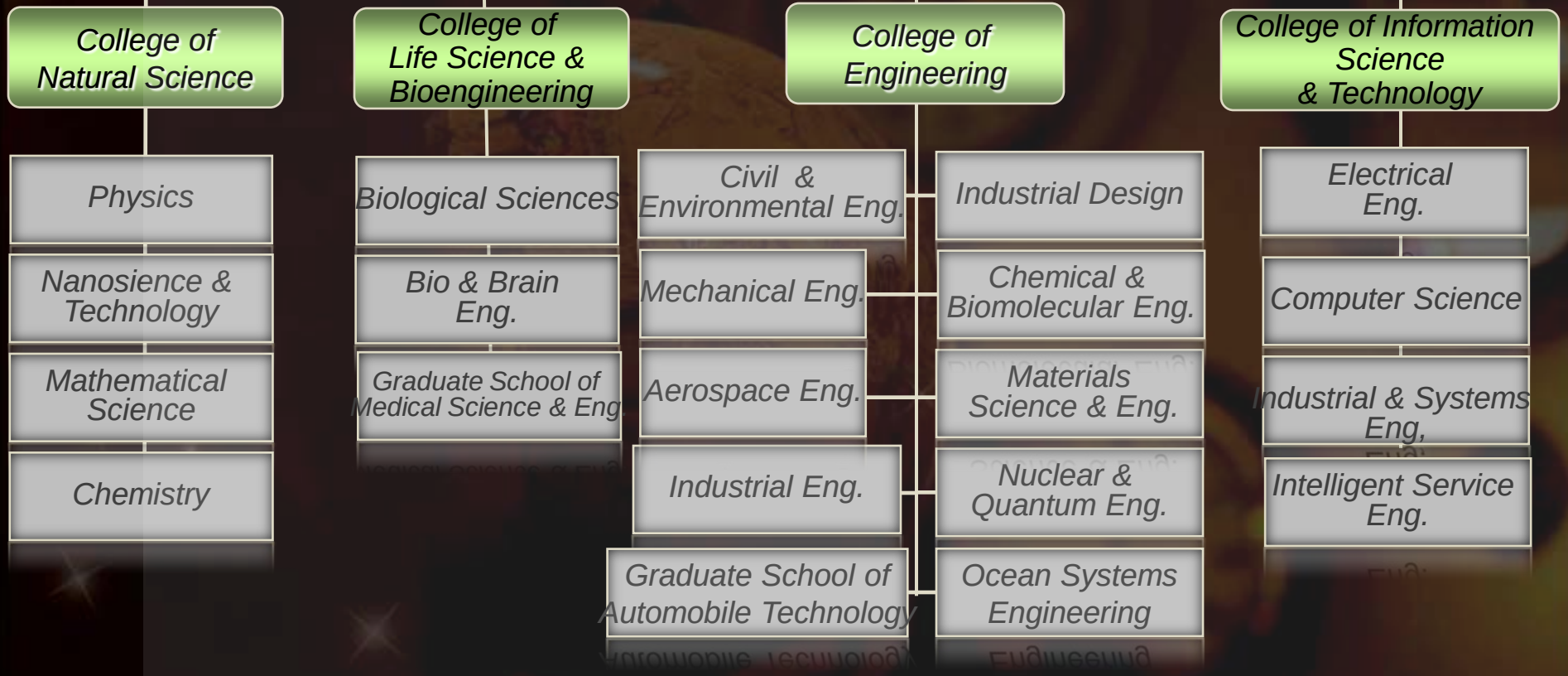
- ***Research-oriented / Innovative Education***
  - ***Maximization of educational effects via mutual interaction with industry***
  - *Cultivation of creativity by emphasizing discussion, experimentation, tutoring, etc*
  - ***Design**/synthesis education, **Bilingual** education, **Dual degree** program*

- ***Well-rounded Education***
  - ***Leadership training***
  - *Strong emphasis on humanities and social sciences*

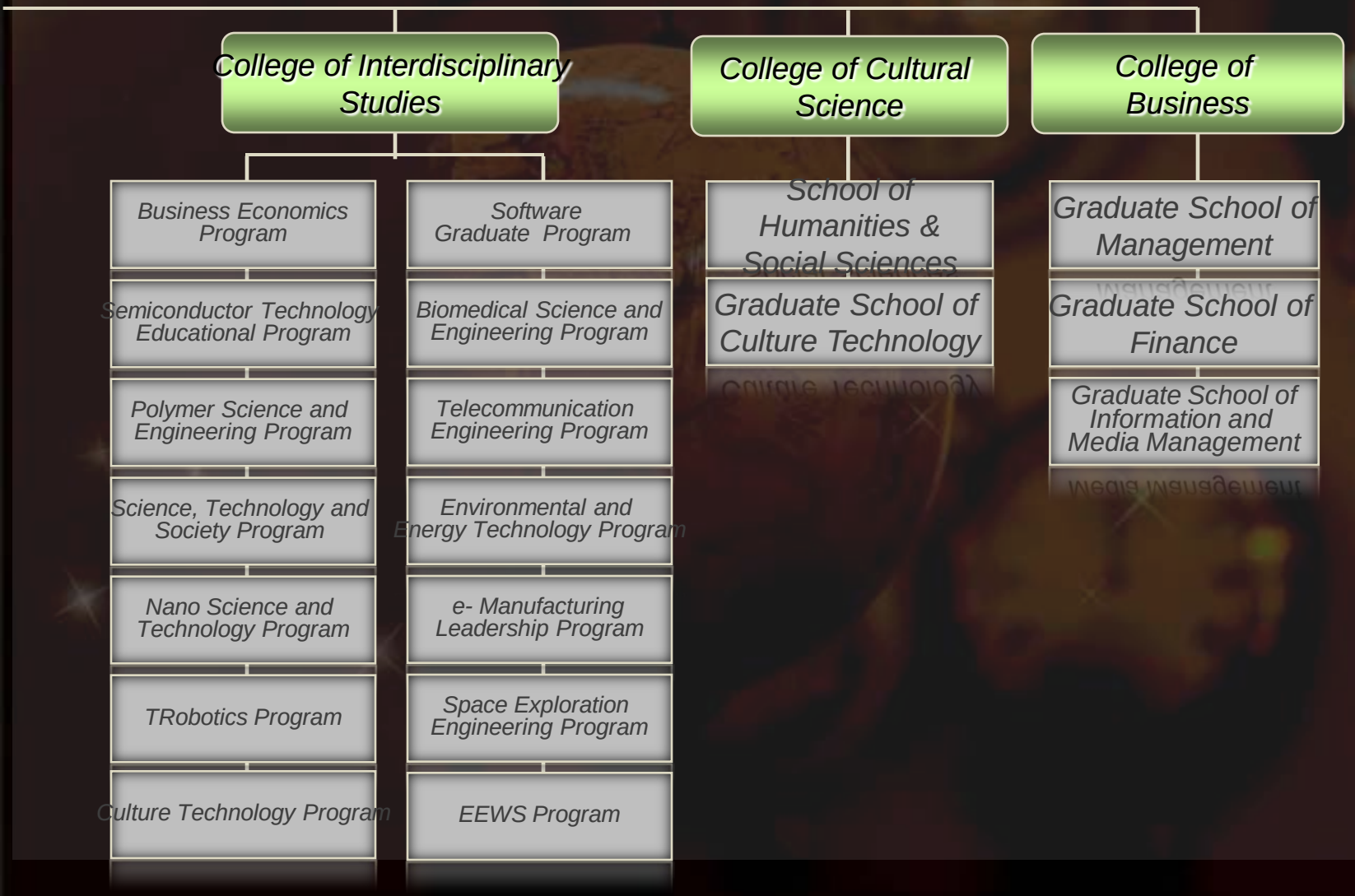
Organization



Academic Programs-(1)



Academic Programs-(2)

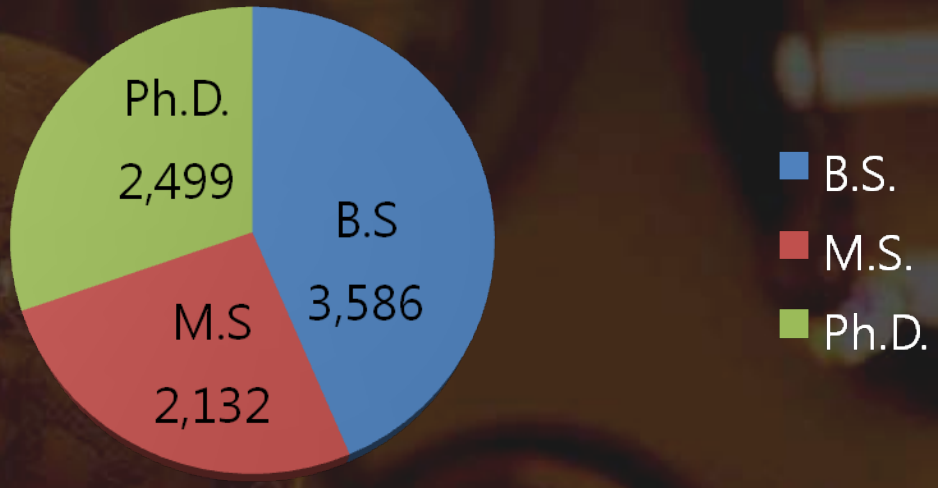


Faculty & Staff

Professors	296	444	1,156
Associate Professors	81		
Assistant Professors	67		
Full-Time Instructor	1		
Professors Emeritus	43	389	
Research Professors	50		
Adjunct Professors	72		
Part-Time Professors	139		
Visiting Professors	77		
Practice Professors	8		
Administrative & Technical Staff	323		

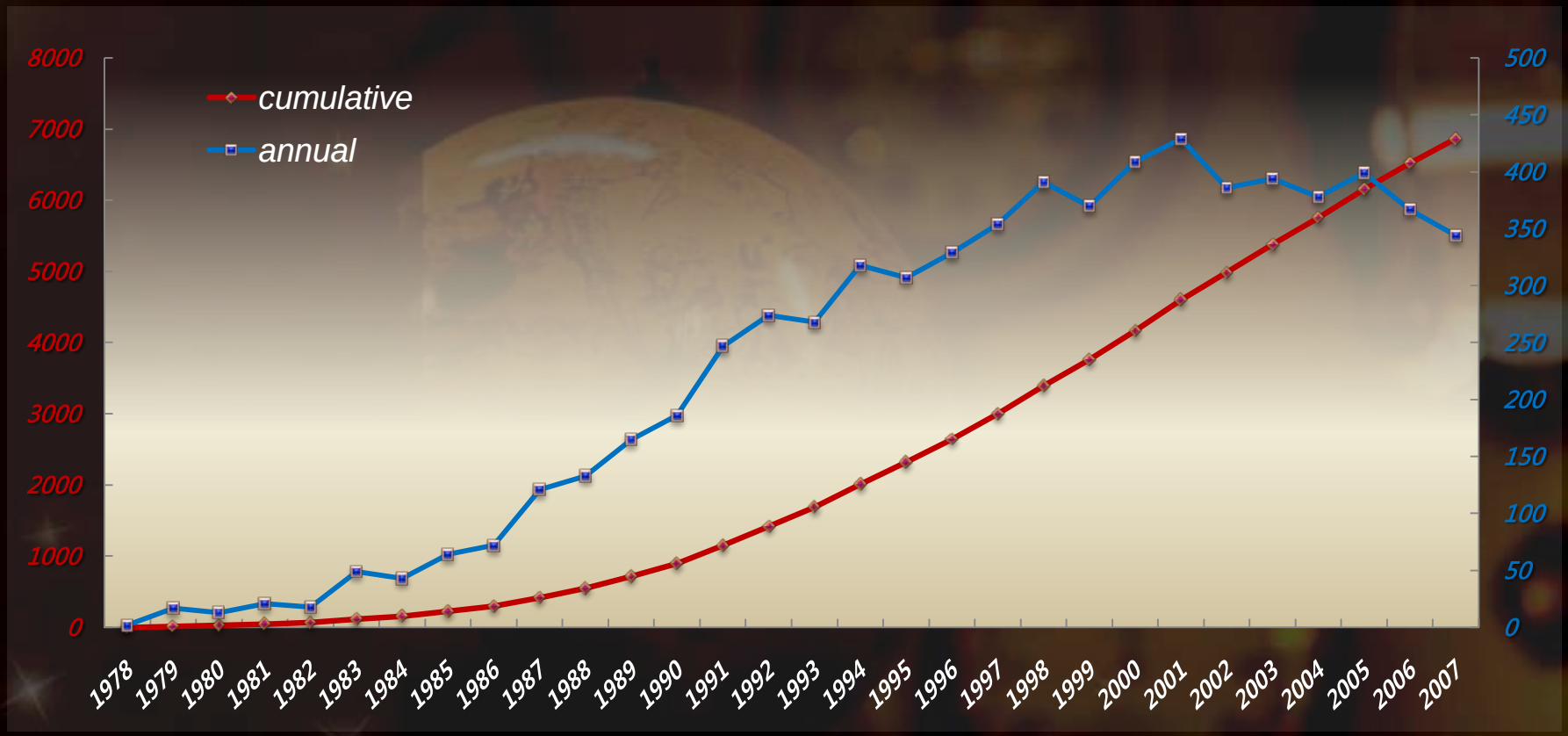
Student Enrollment 2008

Total: 8,217 students



	Students	females	non-Korean
BS	3,586	809	78
MS	2,132	416	92
PhD	2,499	382	105
total	8,217	1,607	275

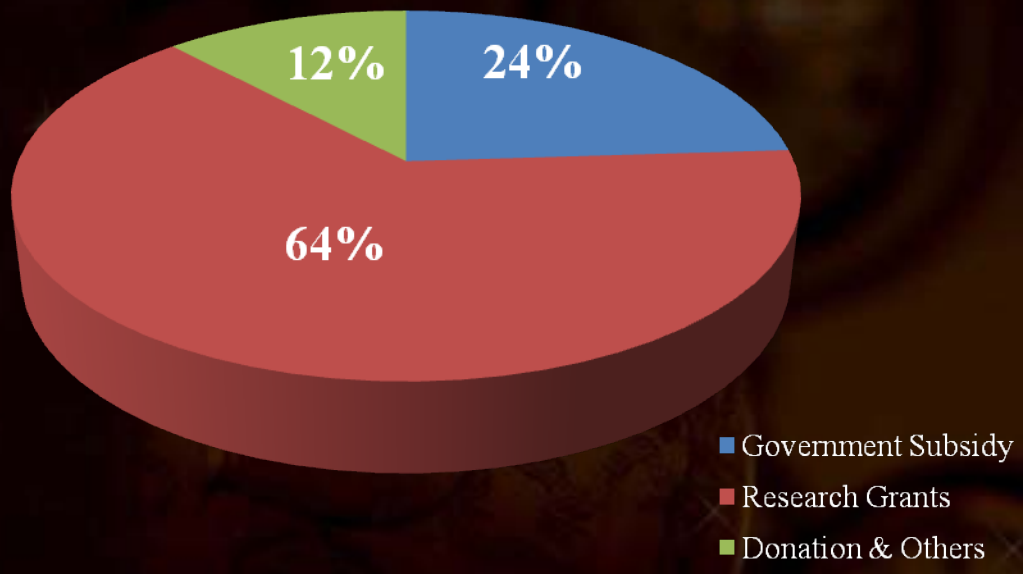
Ph.D. since 1978



Number of Graduates since 1978

BS: 8,602	MS: 17,911	Ph.D.: 6,867

Budget 2008



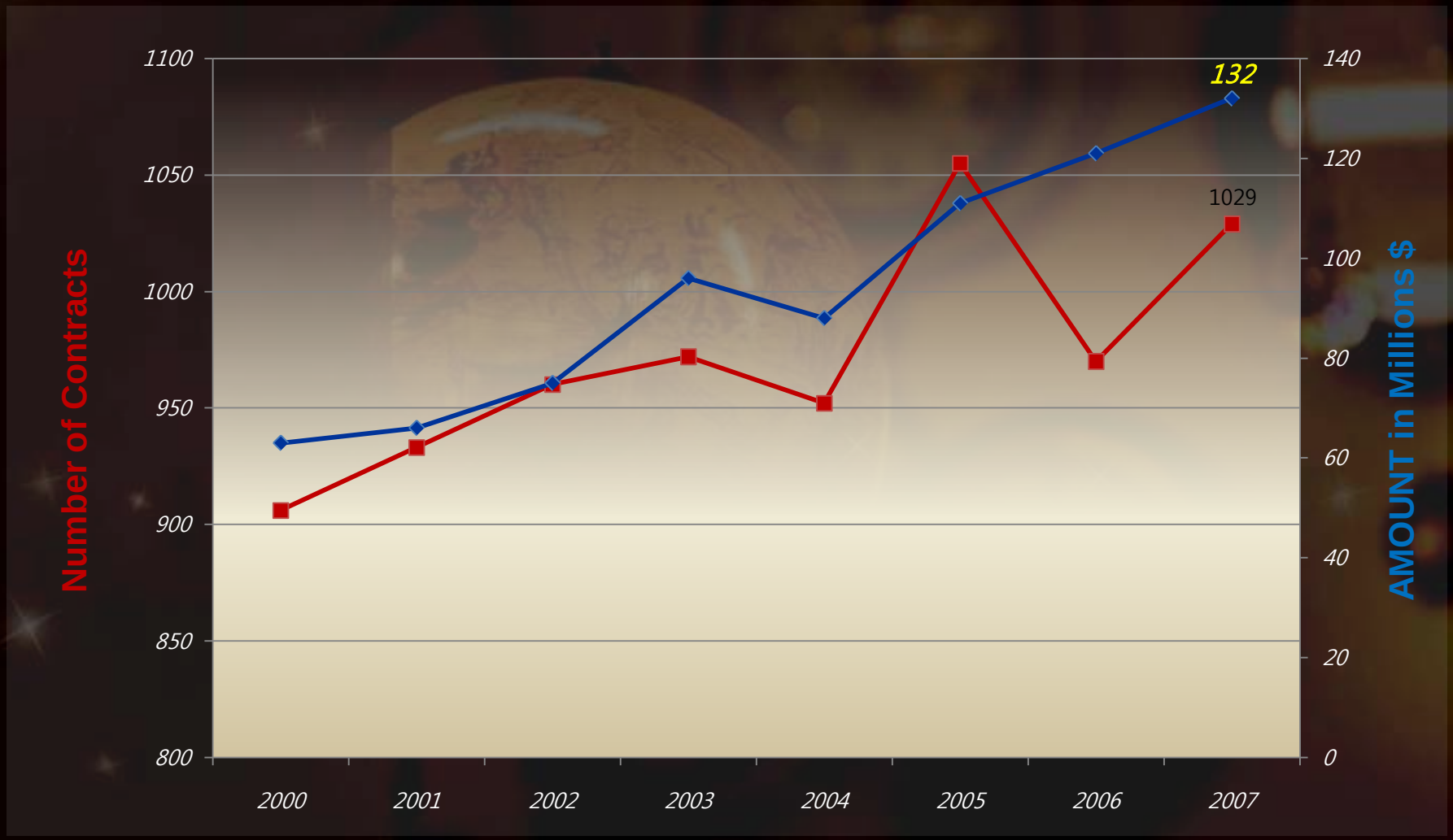
Approx. : 463 Million USD

Government subsidy : 110 (24%)

Research Grants : 295(64%)

Donation & Other Income : 58(12%)

Trends of Research Grants



International Cooperation

- *Cooperation Agreements with 80 foreign institutions in 32 countries for academic cooperation and exchange*
  - *bilateral student exchange programs: 68 overseas partner universities*
  - *dual degree programs:*

    Carnegie Mellon Univ., TU Berlin, TU München , City Univ. London,

    USC Marshall, Univ. of Illinois-Urbana Champaign

- *International joint research activities:*
  - *23 research projects with 12 countries*
  - *Cavendish-KAIST Research Center, Korea-China NanoFab Center*

- *Cooperation with International Organization:*
  - *UNESCO HQ, UNDP, KOICA, CNRS …*

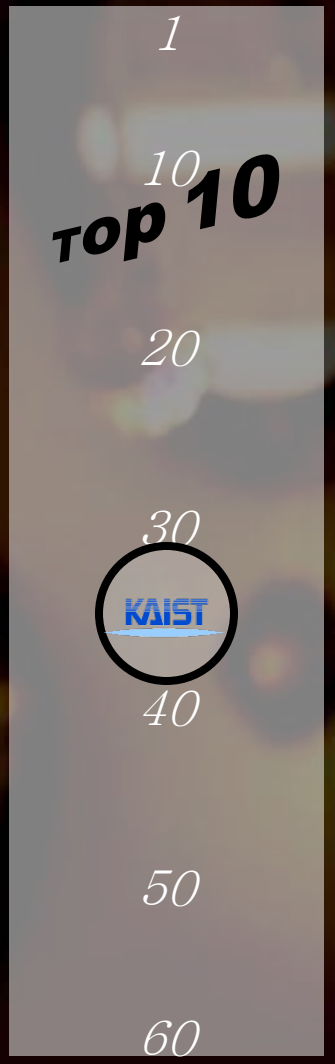
Evaluations & Achievements

- ***Asian Ranking by ASIAWEEK** **
  - *1999 & 2000 : First in "Best Universities in Asia in Science and Technology"*
- ***World Ranking by the THES** ***
  - *2006 : top 37th Technology field*
  - *2006 : top 82nd in Science field*
  - *2007 : top 48th in Technology field*
  - *2007 : top 86th in Science field*
  - *2008 : top 34th in Technology field*
  - *2008 : top 46th in Science field*
- ***World Ranking by CACM** ****
  - *2006 : First in System & Software Engineering*

** ASIAWEEK : weekly magazine published in Hong Kong*
*** THES : The Times Higher Education Supplement*
**** CACM : Association for Computing Machinery*

KAIST in 5 Years

	2006.12	2011
Number of Faculty	421	700
Number of Freshmen	700	1,000
Faculty Age Structure	Above 50, 50%	Under 40, 50%
G. Student : Faculty	10.2 : 1	6 : 1
Budget	$ 450 Million	$ 900Million
International Faculty	1.4%	11.4%
International U. Students	5	200
Number of Female Faculty	16	100
Lecture in English (U.)	26.9%	100%



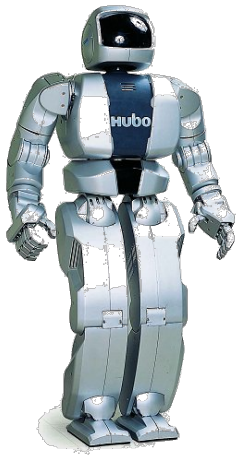
Thank you very much!

Overview

School of Mechanical, Aerospace and Systems Engineering

at

Korea Advanced Institute of Science & Technology



http://me.kaist.ac.kr
http://ae.kaist.ac.kr
http://me.kaist.ac.kr/bk21

Faculty

Position	Professor	Associate professor	Assistant professor	Emeritus professor	Total
ME	45	4	2	1	52
AE	11	2	1	0	14
Total	56	6	3	1	66

Research Field	No. of Professors
Micro/Nano Systems	10
New-Energy Systems	13
Biomedical Engineering	4
IT-based Intelligent Mechanical Systems	11
Mechanics & Design Innovation	8
Pro-Human Engineering	6
Aerospace Engineering	14

Student Enrollment

(September 1, 2008, Current)

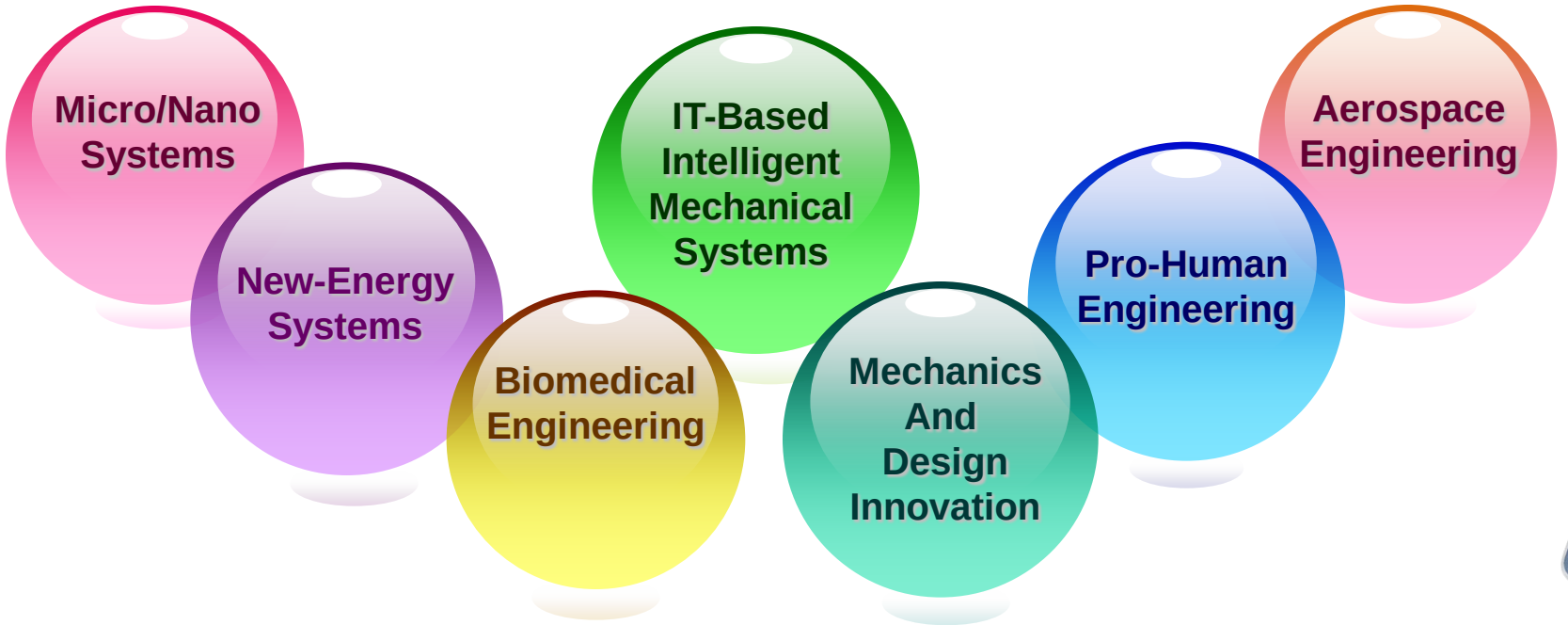
Program \ Funding Category	Government Scholarship	Project Supported	Industry Scholarship	Foreign	Total
B.S	209	-	-	-	209
M.S	202	7	17	14	240
Ph.D	296	28	95	12	431
Total	707	35	112	26	880

Research Activities

The School of Mechanical, Aerospace and Systems Engineering is one of the largest departments at KAIST, and it consists of 66 professors and 10 staffs. Seven research fields are formed based on the research interests of the faculty and students.

School of Mechanical, Aerospace and Systems Engineering

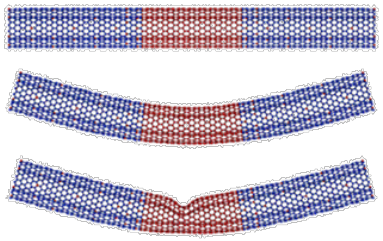
Research Fields



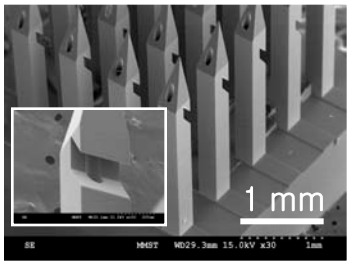
Research Activities

Micro/Nano Systems

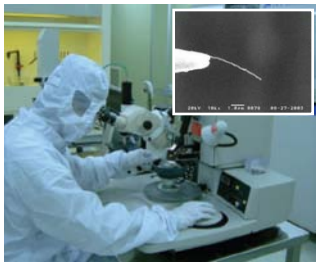
The research areas of Micro/Nano Systems Group include the analysis, control, fabrication and reliability of micro/nano systems. Furthermore, the traditional mechanical engineering branches, such as heat transfer, fluidics, dynamics and solid mechanics are treated as well from the view of the micro and nano scale.



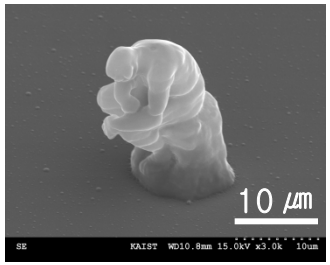
Molecular Dynamics
(Bending simulation of DWCNT)



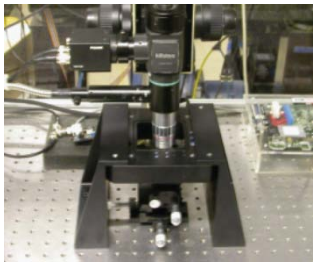
Micro needle array



Nano manipulation
(Nano Gripper)



Nano-stereolithography



Nano positioning

Research Interests

- **Property measurement and behavior analysis in micro/nano scale**
- **Operating mechanism and control of nano systems**
- **Micro fabrication for MEMS and 3D measurement**
- **3D micro/nanofabrication using Nano-Stereolithography**

Major Equipments

- Micro fabrication center, AFM, Nano-indentor, Fe-SEM,
  3D optical coherence measurement equipments, Nano operating systems

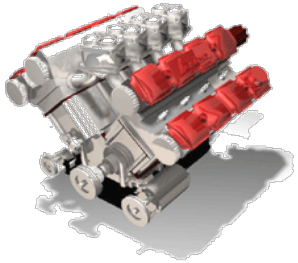
Research Activities

New Energy Systems

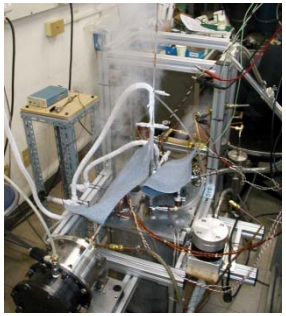
Current research activities are directed to analysis and design of heat transfer and fluid dynamics encountered in power production and energy conversion systems.

Fuel cells

Cold flow test



Hybrid Engine



Cryogenic System

Research Interests

- **Measurements and numerical analyses of heat transfer and fluid dynamics**
- **Flow controls, heat transfer enhancement**
- **Design of energy systems ranging from sub-micro to macro scale**
- **Engines, fuel cells, turbo systems and cooling of electronic devices, hydrogen energy**
- **Production and application of cryogenics and superconductivity**
- **Production and control of micro and nano particles**

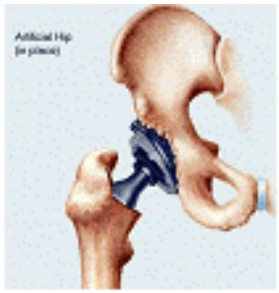
Major Equipments

- Equipment for measurement and analysis: Radiation spectrometer, PIV and micro-PIV, laser-induced florescence, Gas chromatography, GC-MSD, Arrays of computer for CFD
- Apparatus for analyzing thermo-fluid systems: Vehicle engines, Wind and water tunnels, Measurement instruments for micro/nano particles, Combustion furnaces and reactors

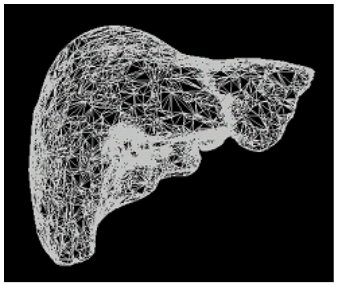
Research Activities
Biomedical Engineering

Biomedical Engineering seeks to gain basic insights into the problems associated with the biological system as well as the medical applications.

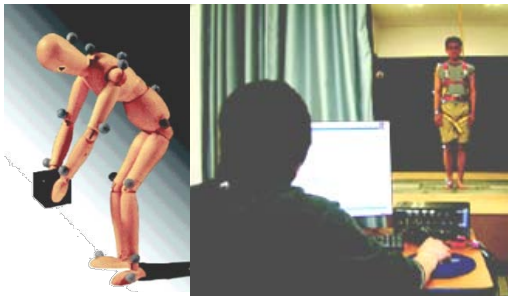
Hip replacement



Artificial joint



Real time simulation of soft-tissue



Biomimetics

Research Interests

- **Biomechanics and Biomaterials**
- **Cell mechanics and Biomimetics**
- **Medical virtual environment and Bioinstrument**
- **Postural control and Sensory integration**
- **Surgery Robots and Tools**

Major Equipments

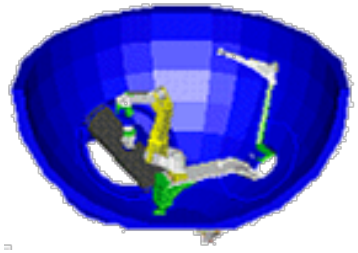
- Tensile tester, X-ray cameras, Operation robots, Stereovision system, Force flatform, Visual human dataset, Motion analyzer

Research Activities

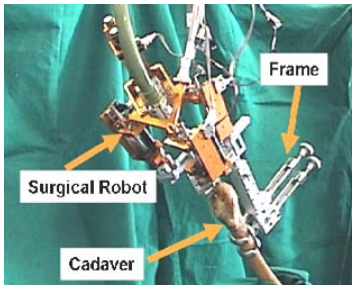
IT-based Intelligent Mechanical Systems

The IT-based Intelligent Mechanical Systems is an interdisciplinary area that combines conventional mechanical technologies and new information technologies. Researches on intelligent robot systems, controls, machines and manufacturing systems are conducted to implant intelligence to machine systems.

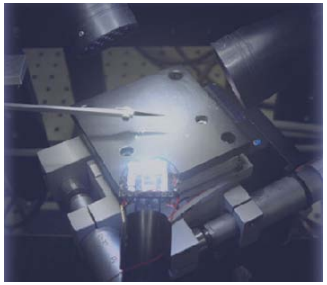
Hubo Robot



8 DOF Robot for Nuclear Power Plant



Surgical Robot



Optomechatronic system

Research Interests

- **Intelligent robot systems (Humanoid, human-robot interaction and haptic interface)**
- **Controls, smart structures and entertainment engineering**
- **Intelligent machines and manufacturing systems**
- **Virtual reality engineering and e-production**
- **Environmental-friendly, intelligent and high precision machine**

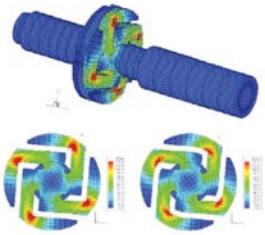
Major Equipments

- Rapid prototyping equipments, 3D Nano-stereolithography apparatus, Robot systems, Humanoid robot, Manufacturing equipments (NC machine, Laser manufacturing systems, Press), CAVE (Computer Aided Virtual Environment) and Simulators

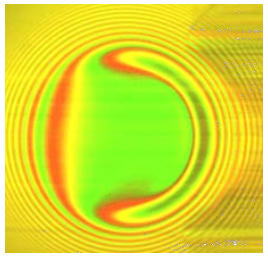
Research Activities

Mechanics and Design Innovation

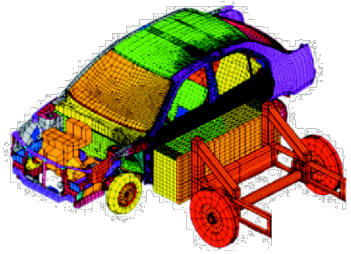
Research activities include creation of future-oriented machines, mechanisms, software, and the technologies for analysis and designs of mechanical systems. Researches on development of innovative technologies for new designs and technological inventions are also conducted.



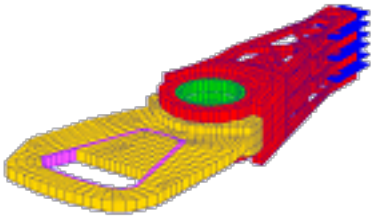
Impact Analysis



Elasto-hydrodynamic Lubrication



Crash Analysis of Auto-body Structures



Development of Constitutive Model

3D FEA of Forming Process

Research Interests

- **Innovation and creation of mechanical systems**
- **Simulation of biological motions**
- **Development of new designs and technologies for modeling and governing equation**
- **Development and application of new materials to mechanical systems**
- **Innovation of the analysis and design programs and tools**

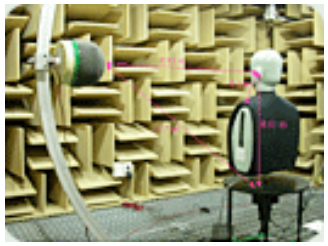
Major Equipments

- Multi-axial tension and fatigue tester, High speed tension tester, DMA apparatus, Hopkinson bar tester, Computerized autoclave with dielectrometry

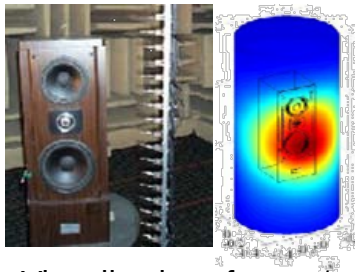
Research Activities

Pro-Human Engineering

Research is focused on analysis and application of the human-oriented devices and systems. Human perception to sound, vibration, vision and touch is analyzed and the research results will be applied to real innovative machine design.

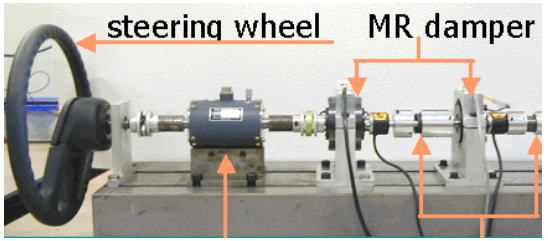


Virtual Audio system



Visualization of sound

Measurement of head Motion



Vibration Experiment

Research Interests

- Biomechanics Researches on generic characters of sound, vibration sound and touch
- Modeling and analysis of sound quality and vibration
- Methodology of evaluating and designing products after considering peculiarity of humans' senses
- Methodology of designing machines interacting between humans and machines
- Researches on machines and systems contributing to human welfares

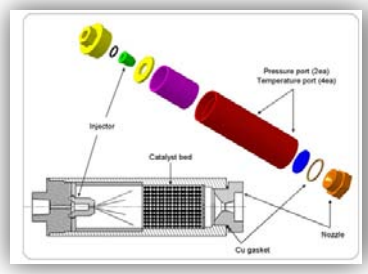
Major Equipments

- Anechoic chamber, Reverberation chamber, Audiometric test booth, Inertia bed, Array sensor, Motion simulator (4 and 6 degree of freedoms), Micro excitation device using electromagnetic levitation, Dynamic characteristics measurement apparatus for viscoelastic materials, Laser Holography, Signal analyzer, Exciters

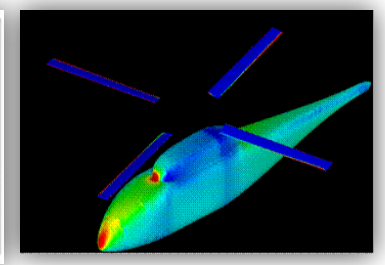
Research Activities

Aerospace Engineering

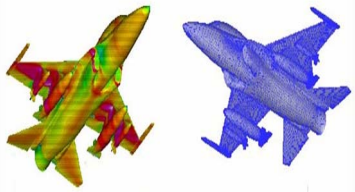
Aerospace engineering is an interdisciplinary study of various engineering fields for atmospheric or space flights. Atmospheric flight vehicles include airplanes, helicopters, and missiles while astronautic flight vehicles include space crafts, artificial satellites, and other space vehicles.



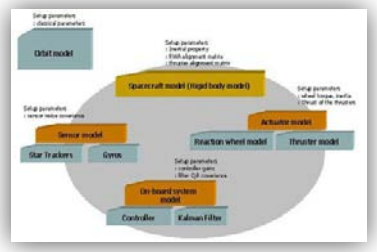
Monopropellant propulsion



Helicopter Aerodynamics



Aerodynamics



Spacecraft Attitude/Orbit Control

Smart structure & Fiber Optic sensor

Research Interests

- Aerodynamics, Fluid Dynamics, and Aeroacoustics
- Smart Composites and Structural Dynamics
- Propulsion and Combustion
- Flight Dynamics and Control

Major Equipments

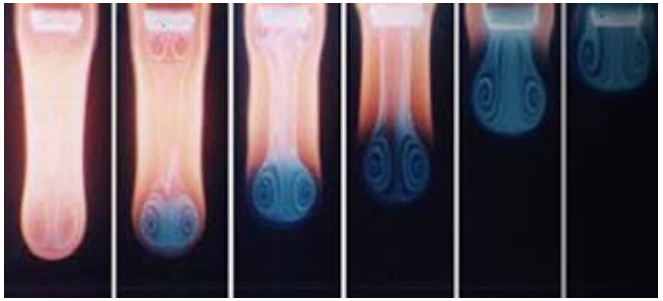
- Low-speed Wind Tunnel, Shock Tube, Low-speed wind tunnel and aerodynamic force measurements of flapping-wing MAV, Combustion Chamber, MEMS fabrication Facilities, Low Earth Orbit (LEO) Simulation Chamber, Universal Testing Machine, Panel Autoclave, Eximer Laser, Active vibration control of composite wing, Anechoic wind-tunnel, Parallel Cluster Spacecraft CMG (Control Moment Gyro)Test Bed

Research Centers

Combustion Engineering Research Center

Engineering Research Center (ERC)

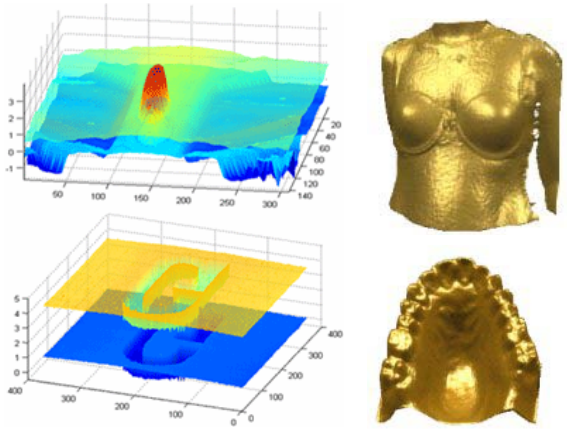
The Combustion Engineering Research Center (CERC) was established to conduct researches producing the basic data on combustion phenomena and to distribute advanced technologies on the reduction of the environmental hazards by the combustion of fossil fuels.



Billionth Uncertainty Precision Engineering Center (BUPE)

Creative Research Initiatives (CRI)

Our lab is for Precision Engineering and Metrology (PEM). PEM has always been one of the most active working groups in precision engineering. PEM also commercialized three different types measurement systems; CMM, 3D Scanners, and ACCURA (PSI,WSI and vision integrated measurement system).



Measured Examples

Human-Robot Interaction Research Center

HRI Research Center, sponsored by 21C Frontier Program, has been established in 2003 with the goal of developing the core technology of human-robot interaction for coexistence of service robots and humans in daily life.

Research Centers

Humanoid Robot Research Center

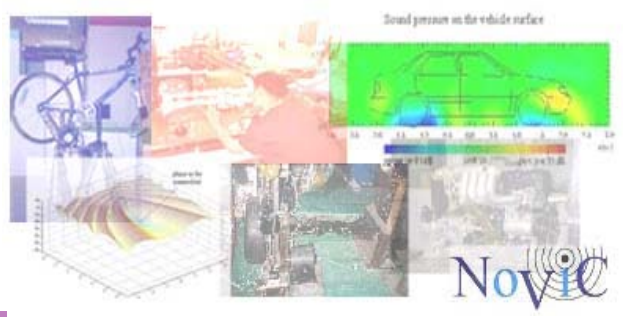
The ultimate goal of the research is to enhance human welfare by providing and advancing robotics technologies that are essential in robot development and human-robot interaction.

Albert Hubo (APEC 2005)

HUBO FX-1

Center for Noise and Vibration Control (NOVIC)

NOVIC (Noise and Vibration Control) research group was established in March 1989 and reorganized as the Center for Noise and Vibration Control in March 1992. The objective of the Center is to promote cooperation with the industry to enhance the education, basic and applied research works in the areas of noise and vibration control.



Unmanned Technology Research Center (UTRC)

UTRC was open in April, 2007. The objective of the center is to perform research for the development of unmanned arms systems for national defense.

Extracurricular Activities

✱ Regular Concert at Lobby in ME Building

✱ Summer/Winter Camp

✱ Deck & Lobby

✱ Computer Room

✱ Gymnasium

Mechanical Engineering

✱ Career Upgrade Program

✱ Research Review

✱ See/Open KAIST Festival

BK21 Program

To nurture world class graduate schools and to foster excellent researchers, Brain Korea 21 (BK21) is a high-quality human resource nurturing program designed to aid the candidates for the master course, PhD and advanced-level researcher.

KAIST Valufacture Institute of Mechanical Engineering

- 1st stage BK21 program
  - Sep. 1999 ~ Feb. 2006
  - Awarded by President of Korea
- 2nd stage BK21 Program
  - Mar. 2006 ~ Feb. 2013
  - KAIST Valufacture Institute of Mechanical Engineering ("Valufacture" means "Value + Manufacture")
- Support for graduate students.
  - Long-Term Exchange Program : Min. 2 months & Max. 12 months
  - Short-Term Exchange Program : To attend and present papers at international/domestic conferences.
  - Open Seminars with Visiting Scholars
  - Foster Postdoctoral Researchers

Vision & Goal

Vision

- Foster elites for Valufacture Institute of ME
- Produce experts on Innovative Mechatronics & Eco-energy fields
- Foster elites equipped with international competitiveness

Goal

A World Leading Department in Education & Research

Action Plan

Education	• Set up multi-interdisciplinary cutting-edge educational curriculum • Provide customized education for students and industries • Produce leaders contributing to 6T • Equip students for the global world • Form Global Advisory Board (GAB)
Research	• Improve quality of paper produced to world's top level • Support patents on the practicality basis • Participate Government R&D projects including 6T
Industrial Cooperation	• Operate Industry-Academia Consortium • Pursue technology transfer & commercialize stage 1 BK21 accomplishments • Secure Avg. 1.6 billion won industry matching fund per year
Specialization	• Build faculty evaluation system and competitive environment • Improve number of students per faculty ratio

Participants

Professor	Graduate Student (*Up to 2nd year of M.S and 4th year of Ph.D Students*)			Researcher		
	M.S	Ph.D	Subtotal	Visiting Professor	Post-doc.	Subtotal
64	236	290	526 *(78% of the total students)*	2	23	25

Thank you for your attention

For further information, please visit the following websites:

KAIST	http://www.kaist.ac.kr
ME Department	http://me.kaist.ac.kr
AE Department	http://ae.kaist.ac.kr
BK21	http://me.kaist.ac.kr/bk21