

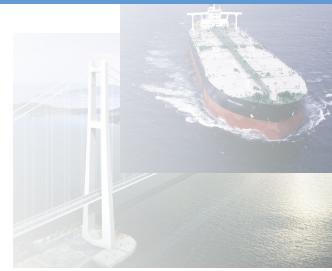
CFD in EDISON Web Portal



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2014. 4. 9.

Contents



- **Introduction**

- **EDISON_CFD**

- Platform
- Simulation programs and contents
- Utilization in education



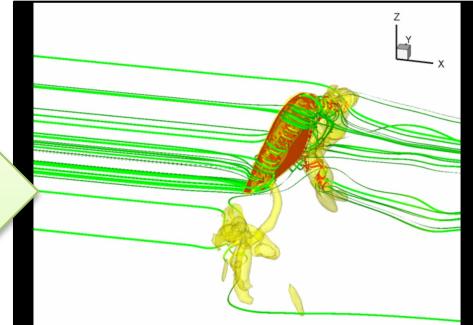
Introduction

Goals of EDISON_CFD

- By utilizing simulation programs and contents
 - Attracts the students' interests and develops students' research spirits
 - Constructs a virtuous cycle between research and education in thermo-fluids engineering
 - Improves adaptability to the computational technology of students

Ch.8: Navier-Stokes equations
Newtonian rheology: $\underline{\underline{\sigma}} = -p(z,t)\underline{\underline{I}} + \underline{\underline{\tau}}(z,t)$ pressure viscous stress tensor
with $\underline{\underline{\tau}} = \lambda_n(\text{tr}\underline{\underline{\tau}})\underline{\underline{I}} + \underline{\underline{\epsilon}}\mu_n \underline{\underline{D}}$

$\underline{\underline{\tau}}(D)$: linear dependency with isotropy
since $\sigma_{xy} = -p\delta_{xy} + \lambda_n \frac{\partial u}{\partial x} \delta_{xy} + \mu_n \left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} \right)$
 $\underline{\underline{\tau}} = -p\underline{\underline{I}} + \lambda_n \text{div} \underline{\underline{U}} \underline{\underline{I}} + \underline{\underline{\epsilon}}\mu_n \underline{\underline{D}}$
then $\frac{\partial}{\partial t} \underline{\underline{\tau}} = -\text{grad} p + (\lambda_n \mu_n) \text{grad}(\text{div} \underline{\underline{U}}) + \mu_n \Delta \underline{\underline{U}}$
Conservation of momentum:
 $p \frac{du}{dt} = \underline{\underline{f}} + \frac{\partial}{\partial z} \underline{\underline{\tau}}$



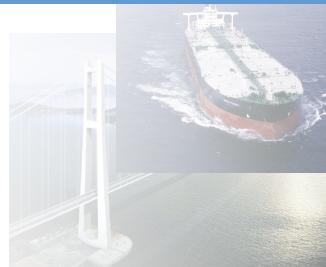
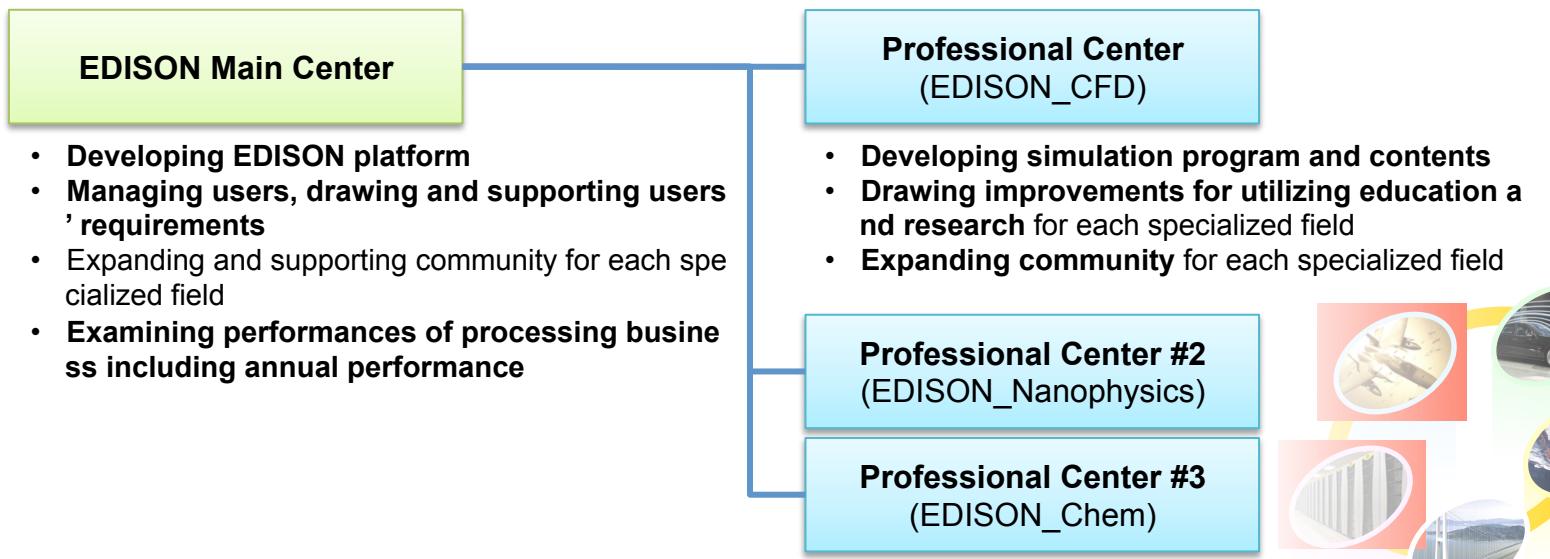
Traditional Education

Education Utilizing Computation/Simulation

Introduction

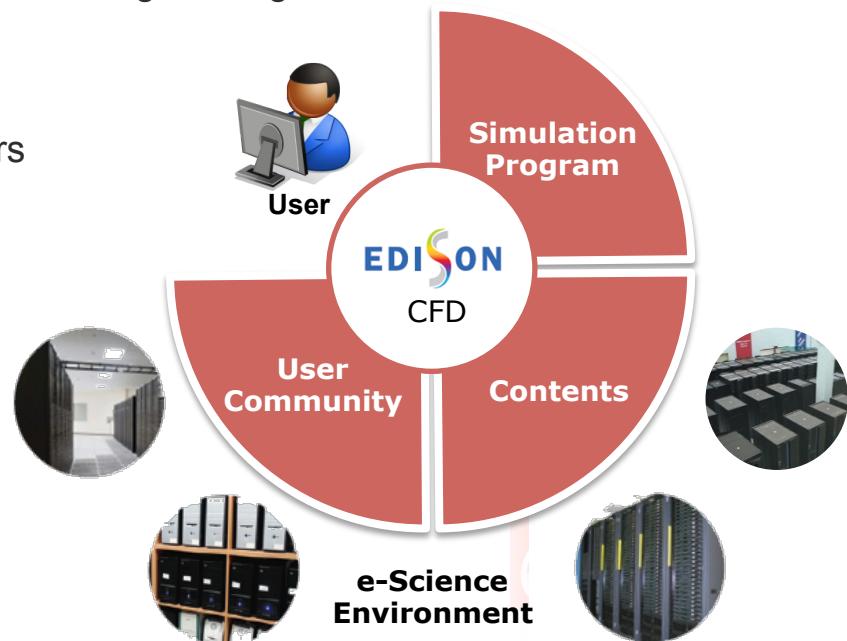
Main Roles of Centers

- EDISON main center
 - Building the EDISON platform
 - Developing a framework and middleware
 - Providing an infrastructure
- EDISON_CFD professional center
 - Developing simulation programs and contents
 - Utilizing in education
 - Supporting user community



- **EDISON_CFD,**
(EDucation-research Integration through Simulation On the Net for CFD)

- Education/research-integrated environment for thermo-fluids engineering
 - Online environment based on e-Science technology
 - Possible to access the environment **via the internet without the constraints of time and location**
- Provides simulation programs and contents
 - Various simulation programs on thermo-fluids engineering
 - Educational contents with simulations
- Supports user community
 - For students, professors, and researchers



EDISON_CFD: Platform

- **Framework**

- For portal service and application
- Manages the metadata of the simulation program
- Provides an interface between the simulation components
 - E.g. Pre/postprocessor, simulation program, job scheduler, web GUI, etc.

- **Middleware**

- Manages hundreds of simulation jobs simultaneously with a distributed processing technology

- **Infrastructure**

- Provided and maintained by KISTI (Korea Institute of Science and Technology Information) Supercomputing Center



Browsers



Portal Service Framework

Application Framework

EDISON Middleware

Simulation/Job Manager, Solvers/Tools Manager, Physical/Virtualized Resource Manager

Infrastructure

Computing Resources, Storage, Network

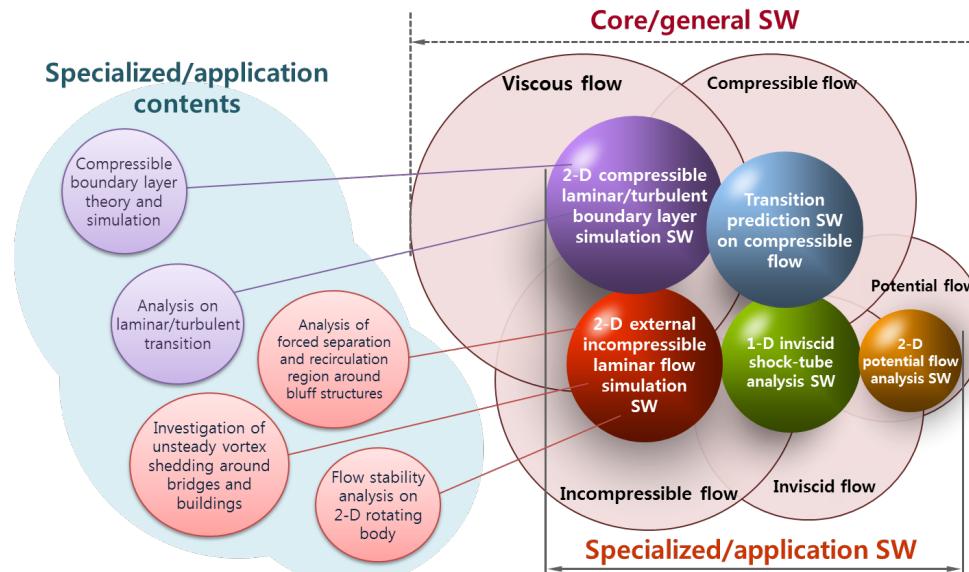


• Simulation Programs

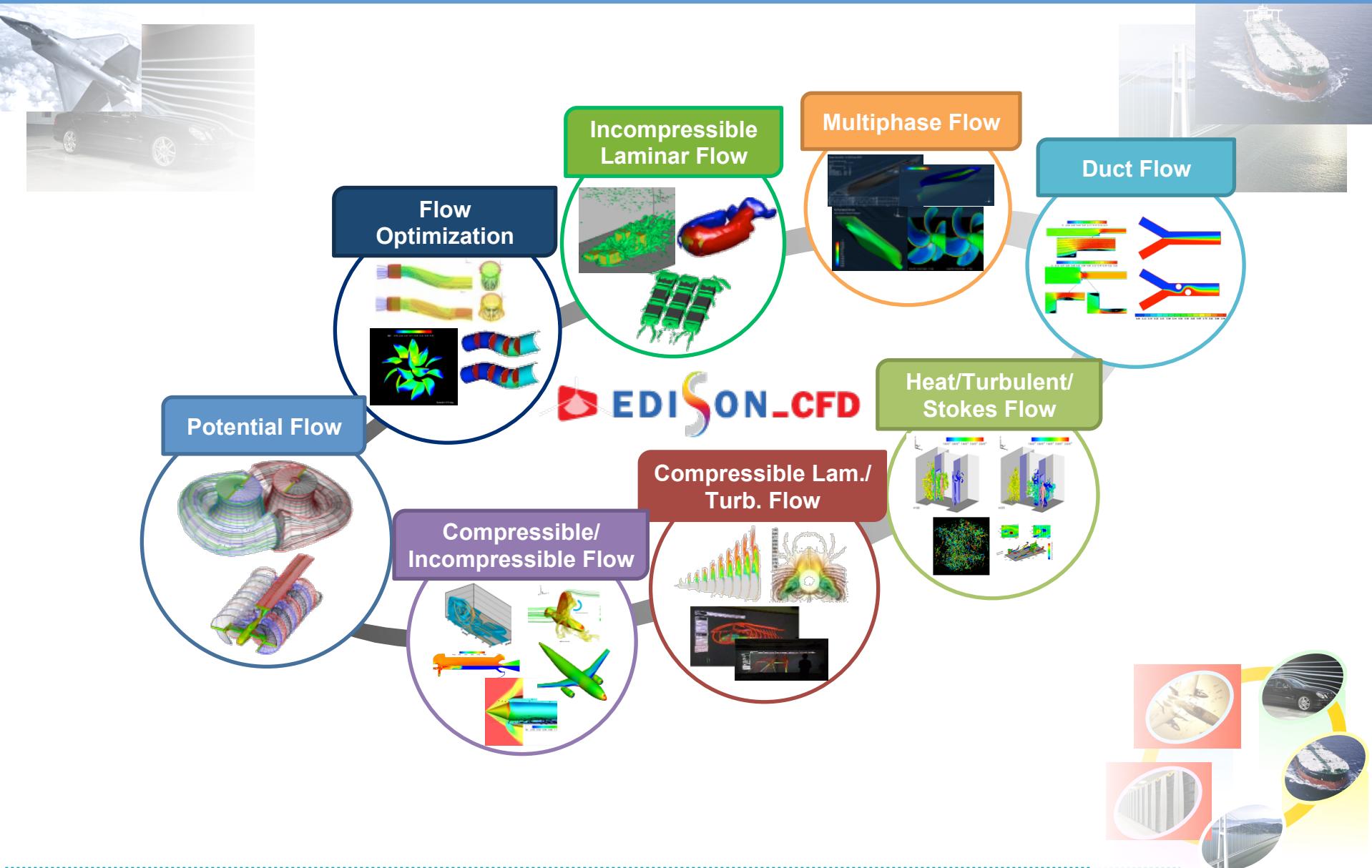
- General-purpose programs
 - Have a capability to **solve a wide range of flow problems**
- Specialized programs
 - Focus on **solving specific problems efficiently and accurately**

• Education Contents

- Deal with a **specific subject related to textbook**
- Have a **connection to the simulation programs** → Students **accomplish a deeper understanding about the subject by carrying out simulations**



EDISON_CFD: Simulation Programs

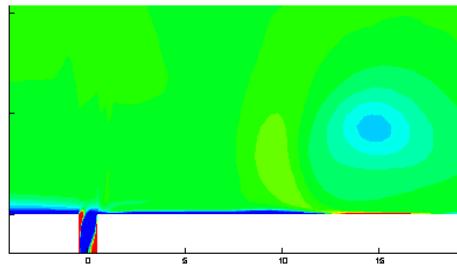


EDISON_CFD: Simulation Programs

• Examples using Representative Simulation Programs

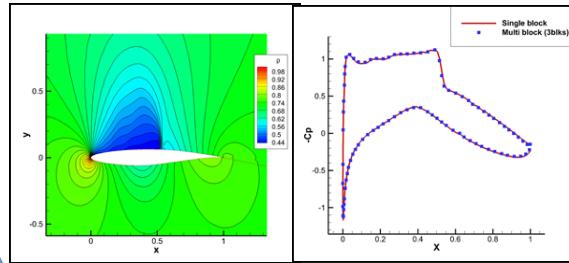
Compressible/ Incompressible Flow 1

- Synthetic jet flow using multi-block k incompressible N-S solver



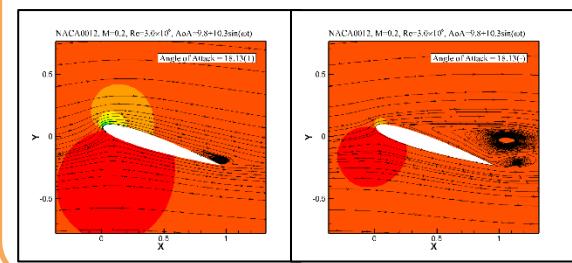
Compressible/ Impressive Flow 2

- Transonic flow over RAE2822 air foil using multi-block compressible N-S solver



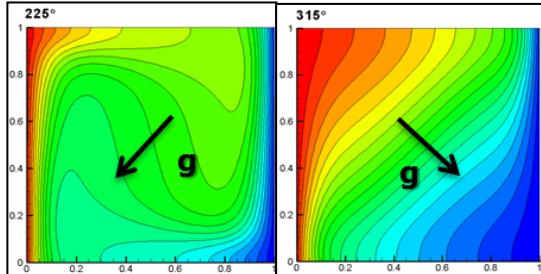
Compressible Lam./Turb. Flow

- Flow over NACA0012 when increasing/decreasing AOA using dynamic analysis solver



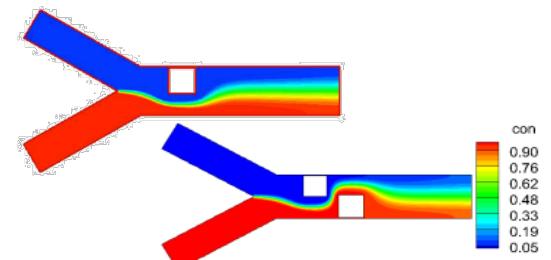
Heat/Turbulent/ Stokes Flow

- Natural convection flow depending on the direction of gravity using heat transfer solver



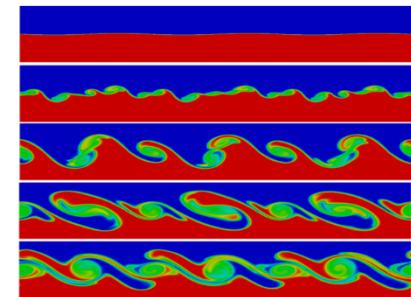
Duct Flow

- Y-channel flow depending on arrangement of obstacles using mixing channel flow solver



Multiphase Flow

- Kelvin-Helmholtz instability flow using free surface flow solver



EDISON_CFD: Education Contents

Representative Education Contents

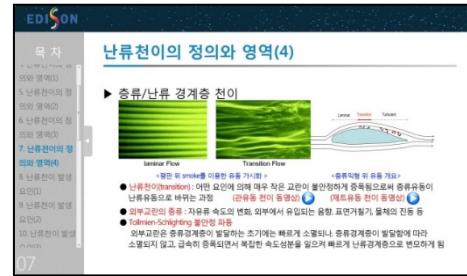
EDISON_CFD and thermo-fluids engineering

- Introducing EDISON_CFD and thermo-fluids engineering



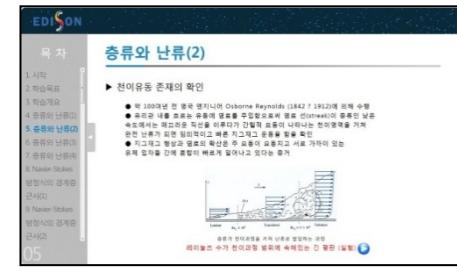
Understanding the laminar-turbulent transition

- Understanding the transient process from laminar to turbulent flow



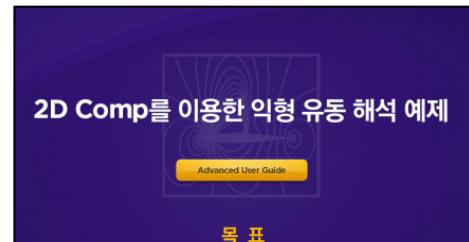
Analysis of differences between lam. and turb. incomp. flow and theoretical background of self-similarity solution

- Understanding the background of boundary layer in laminar and turbulent incompressible flow



Interactive user manual for general-purpose simulation program

- Introducing how to use general-purpose simulation program, pre/post-processor, and web portal



EDISON airfoil design manual

- Introducing an optimization theory, a sensitivity analysis and a shape functions with design optimization of airfoil



Utilization of EDISON_CFD in Education

- The Summary of Utilization for Education in Thermo-Fluids Field

- For undergraduate and graduate students
 - Performing CFD simulation using EDISON_CFD
 - Obtaining a deeper understanding, a capability to solve problems
- 2011 2nd semester~2012 1st semester: 16 colleges, 58 subjects, 1802 students
- 2012 2nd semester~2013 1st semester: 20 colleges, 68 subjects, 2294 students

2011~2013: 36 Universities, 126 Subjects, 4096 Students

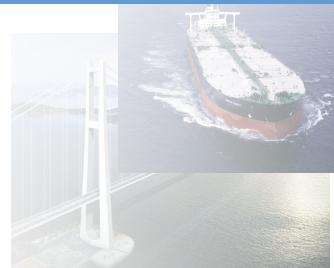


Utilization of EDISON_CFD in Education

EDISON Competition in Thermo-Fluids Field

- To increase a capacity of undergraduate students for solving flow problems
- To promote the utilization of EDISON_CFD
- Participants present research on the self-selected topic using simulation programs in EDISON_CFD
- 8 teams are awarded





Thank you.



Demo

EDISON_전산열유체

전산열유체 소식 시뮬레이션 수업 게시판 사용자관리(조교)

Computational Fluid Dynamics

Bridge to Computational Science for Higher Education and Advanced Research

Self-propulsion test
KCS container with KP205 propeller

propeller rotated angle = 0 deg propeller rotated angle = 32 deg

이성욱 님

탈퇴 나의정보 로그아웃

EDISON 소개동영상

클릭하시면 새 창에 동영상이 재생 됩니다.

Cluster	Total	Used	Avail
baekdusan	112	0	112
solbaram	144	0	32
sinbaram	256	0	256

참여기관 및 활용대학

뉴스

제2회 첨단사이언스 교육·허브 개발(EDISON) 견◆ ...
2013-01-10

제2회 첨단사이언스 교육·허브 개발(EDISON) 경◆ ...

[보도자료] 첨단 사이언스 교육·허브 개발(ED ...
2012-05-14

교육과학기술부는 7.11일 「첨단 사이언스 교육 ...

FAQ

Q cfd 웹 툴을 수업 기간외에도 연구에 활용하...
A cfd 웹 툴은 교육 회원과 연구원 회원이 구분...

Q 회원 가입을 했는데 사이트 로그인이 되지 않...
A 회원 가입에 대한 승인이 이루어져야 cfd 툴...

자료실

제1회 EDISON_열유체 경진대회 논문 및 발표자료 ...
2012-05-14

제1회 EDISON_열유체 경진대회의 논문 및 발표자 ...

공지사항

제2회 EDISON Winter Workshop 개최
제2회 첨단사이언스 교육·허브 개발(EDISON) 전산열유체 경진대회 공고