



**Introducing...**  
**Dr. Sara Fawal**  
**Aerospace Engineering**

# Professional skills & Awards

Professional Skills	Awards
<b>Software:</b> MATLAB, Simulink, ANSYS Fluent, Gambit, Tecplot, FIDAP, AutoCAD, CATIA, MS Office, DOORS, C/C++	<ul style="list-style-type: none"><li>• Richard Cheng Design Award in Mechanical Engineering (2010)</li><li>• NSERC (2008, 2009, 2010)</li><li>• CRIAQ (2009)</li></ul>

Career Objectives	
<ul style="list-style-type: none"><li>• Acquire a challenging position</li><li>• Gain a deeper and more detailed understanding of Aeronautical &amp; Astronautical engines</li><li>• Develop an intelligent/adaptive, efficient, effective and higher power producing engine</li></ul>	<ul style="list-style-type: none"><li>• Work in high quality engineering R&amp;D environment</li><li>• Enhance critical thinking and analysis</li><li>• Being involved in a dynamic and multi-disciplined team</li></ul>

Hobbies
Taekwan-Do, Designing my own clothes, Listening to music

# Education

## **Istanbul Technical University (December 22 - 2023)**

- Doctoral Degree in Aeronautical Engineering



## **Concordia University (October 2 - 2015)**

- Masters of Mechanical Engineering – Thermo-Fluids and Propulsion



## **Concordia University (May 20 - 2011)**

- Bachelor of Mechanical Engineering – Thermo-Fluids and Propulsion

## **University of Waterloo (October 23 – 2004)**

- Bachelor of Honours Science – Biology Minor

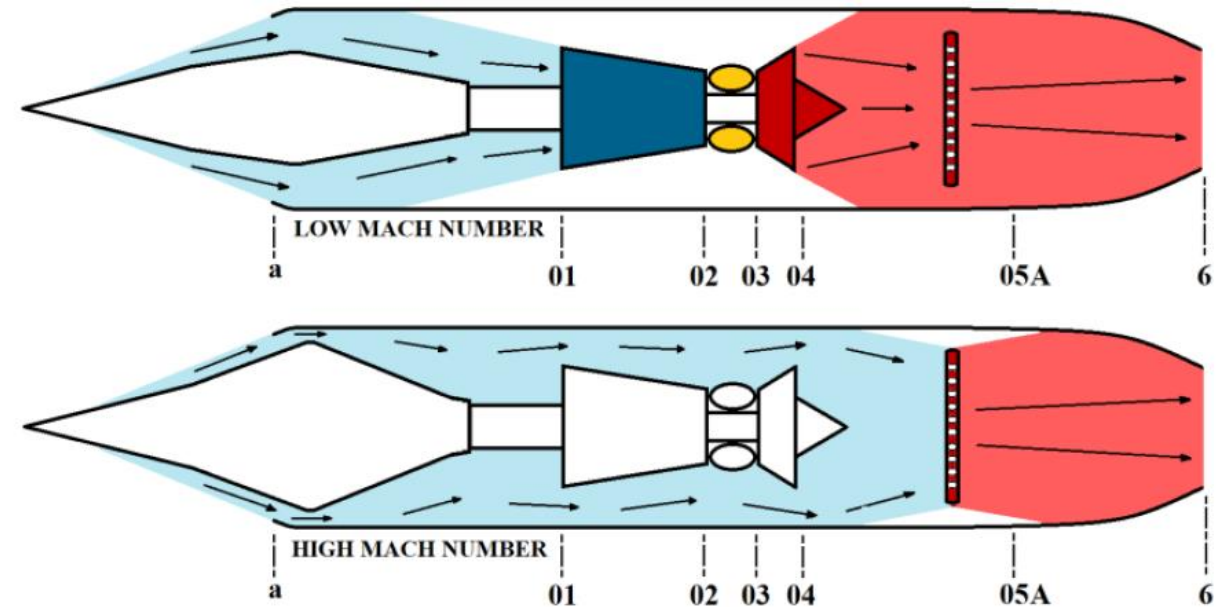


## PhD Thesis Subject:

- Advanced Energy and Exergy Analysis on Aircraft Jet Engines
  - Turbojet Engine without Afterburner
  - Turbojet Engine with Afterburner
  - Ramjet Engine
  - TBCC: Turboramjet Engine

- Link to Thesis:

<https://polen.itu.edu.tr/items/a76df81a-4f87-405d-b301-d9e6500136d3>



## Published Papers:

- **Fawal S. and Kodal A. (2019)** Comparative performance analysis of various optimization functions for an irreversible Brayton cycle applicable to turbojet engines, **Energy Conversion and Management**, 199 111976. (Article Instance).
  - <https://doi.org/10.1016/j.enconman.2019.111976>
- **Fawal S. and Kodal A. (2021)** Overall and Component Basis Performance Evaluations for Turbojet Engines Under Various Optimal Operating Conditions, **Aerospace Science and Technology** 117 106943. (Article Instance).
  - <https://doi.org/10.1016/j.ast.2021.106943>

# Work Experience



**Istanbul Gelisim University:** Faculty of Aeronautical Engineering  
Asst. Prof. Dr. Sara Fawal (2023 - Current)

## What is Dr. Asst. Prof.?

- Courses taught (English):
  - Undergraduate:
    - **Fall 2024-2025:** Introduction to Aeronautical Engineering and Ethics, Computer Aided Technical Drawing, Experimental Methods in Engineering.
    - **Spring 2023-2024:** Statics, Strength of Materials II, Introduction to Aeronautical Engineering and Design, Material Science
  - Graduate:
    - **Fall 2024-2025:** Computational Fluid Dynamics
- Courses taught (Turkish):
  - Undergraduate
    - **Fall 2024-2025:** Computer Aided Technical Drawing
    - **Summer 2023-2024:** Thermodynamics

# Work Experience



**Istanbul Gelisim University:** Faculty of Aeronautical Engineering  
Asst. Prof. Dr. Sara Fawal

**What is Dr. Asst. Prof.?**

- Coordinatorship:
  - Quality Control of Documentation
  - Undergraduate Internships
  - Erasmus Students

**Istanbul Gelisim University:** Vocational School

Asst. Prof. Sara Fawal

**What is Asst. Prof.?**

- Courses taught (Turkish):
  - Vocational School
    - **Fall 2023-2024:** Physics, Gas Turbine Engines and Applications I
    - **Summer 2022-2023:** Thermodynamics, Fluid Mechanics

# Work Experience



## Pratt & Whitney Canada: Operability Analysis Integration & Simulation (2013 -2017)

### What is Operability?

- Ability to keep an equipment, a system or a whole industrial installation in a **safe and reliable functioning condition**, in accordance to pre-defined operational requirements.
- For a gas turbine engine, operability is the ability of the engine to operate **without compressor stall or surge, combustor flame-out or other power loss**.
- Operability engineers work in the fields of engine and compressor modeling, **control and test to ensure the engine meets its ignition, starting, acceleration, deceleration and over-speed requirements under the most extreme operating conditions**.
- Operability is closely related to reliability, supportability and maintainability.



Federal Aviation  
Administration



**EASA**  
European Aviation Safety Agency



# Work Experience



## Pratt & Whitney Canada: Operability Analysis Integration & Simulation

### Operability Functions:

- Certification Campaign
- Margin Analysis
- Operating Envelope Validation / Expansion
- Engineering and Test Instruction
  - Procedure refinement / improvement
- Engine Drag Analysis
- Compressor mapping
- Quality Signature Improvement



# Work Experience



## Pratt & Whitney Canada: Operability Analysis Integration & Simulation

### Operability Documentations:

- OPER-INT Memos (Operability-Integration)
- Certification Memo
- IM: Installation Manual
- MM: Maintenance Manual
- ORT: Operability Request for Test
- E&TI: Engineering & Test Instruction
- ORD: Operability Requirements Document
- CSRD: Control System Requirements Document



# Work Experience



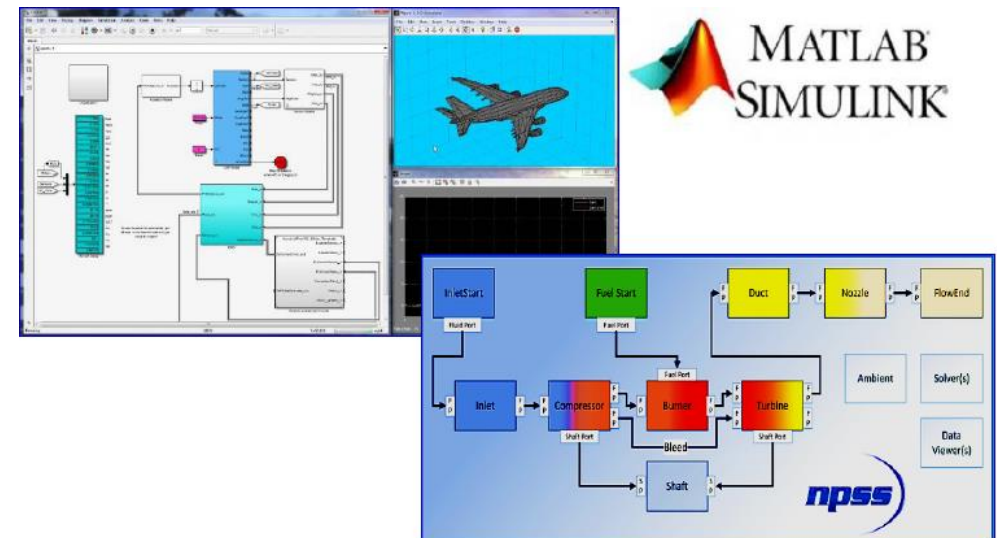
## Pratt & Whitney Canada: Operability Analysis Integration & Simulation

### What is Simulation?

- The Imitation of the operation of a real-world process or system over time. The act of simulating something first requires that a **model be developed**; this model represents the key characteristics, behaviors and functions of the selected physical or abstract system or process. The **model represents the system itself**, whereas the **simulation represents the operation of the system over time**.

### Types of Models:

- NPSS: Numerical Propulsion System Simulation
- Matlab / Simulink
- Legacy Models: FORTRAN, MATRIXx



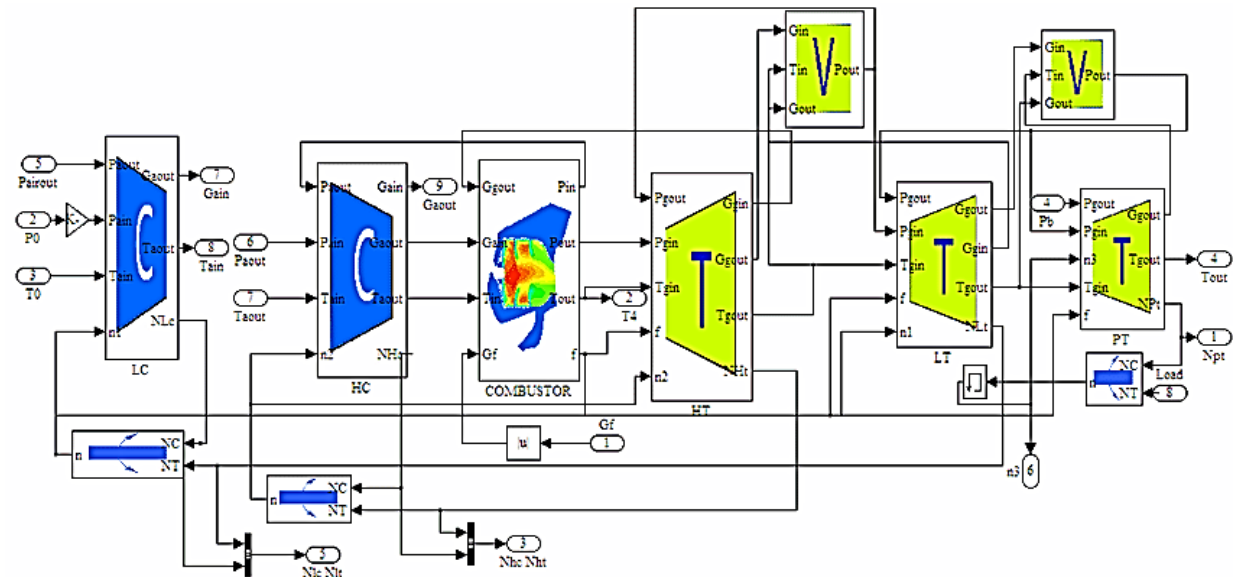
# Work Experience



## Pratt & Whitney Canada: Operability Analysis Integration & Simulation

### Simulation Functions:

- Capability of Detecting Engine Hardware Defects
- Engine Dynamic Alignment
- Update of Component Definition
- Update of Model I/O
- MVM Model Development
- FADEC Update



# Work Experience



## Pratt & Whitney Canada: Operability Analysis Integration & Simulation

### Simulation Documentations:

- SimSBR: Simulation Software Build Request
- SimCR: Simulation Change Request
- SimUDD: Simulation User Description Document
- ATP: Acceptance Test Procedure
- CSRD: Control Systems Requirement Document
- CSCR: Control Systems Change Request



# Work Experience



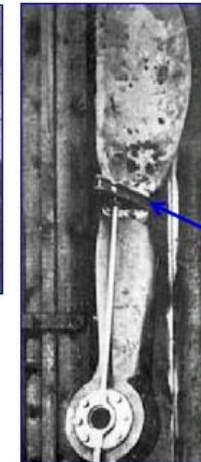
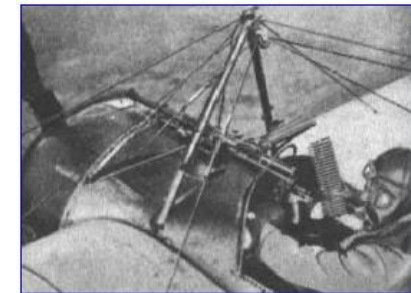
## Pratt & Whitney Canada: Operability Analysis Integration & Simulation

### What is a Control System?

- A Control System manages, commands, directs or **regulates the behaviour** of other devices or systems. In the most common form, the **feedback control system** it is desired to control a process, called the **plant**, so its output follows a **control signal**, which may be a fixed or changing value. The control system compares the output of the plant to the control signal and applies the difference as an error signal to bring the output of the plant closer to the control signal.

### Types of Control Systems:

- On a System Level: FADEC, EEC
- On a Component Level: PLA/TLA, FCU, IGV, Fan/Propeller



Bullet Deflector

# Work Experience



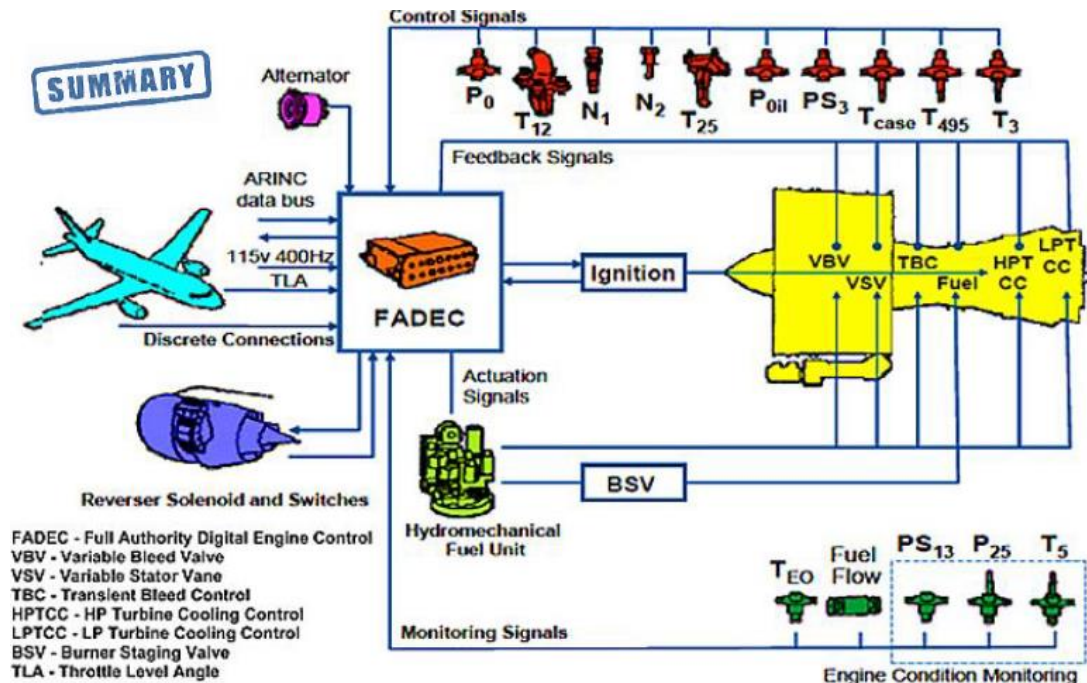
## Pratt & Whitney Canada: Operability Analysis Integration & Simulation

### Control Functions:

- Software Validation for SOF
  - Updating CSRD and VTP via DOORS
  - Running tests on CLB
  - Auditing
  - Generating VTR

### Control Documentations:

- CSRD: Control Systems Requirement Document
- ICD: Interface Control Document
- VTP: Validation Test Plan
- VTR: Validation Test Report



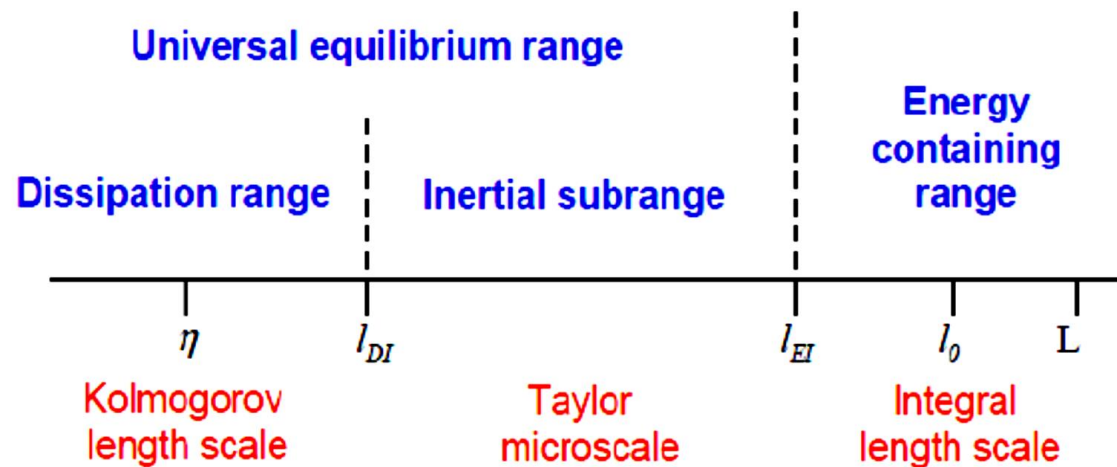
# Work Experience

## Rolls Royce: R&D LCGO Combustion Turbulence Modelling (Internship 2011)

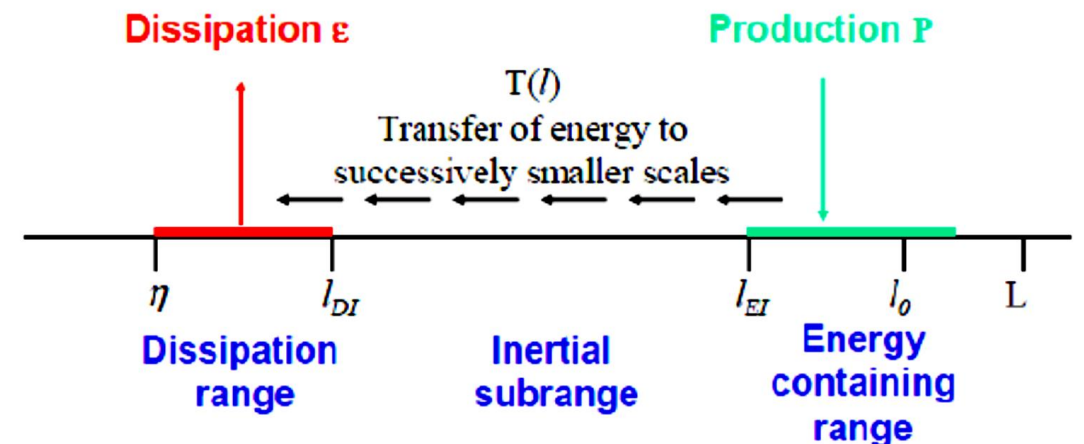
### What is Turbulence?

*“Big whirls have little whirls, That feed on their velocity; Little whirls have smaller whirls, And so on to viscosity.”* - Sir. Lewis Fry Richardson

### Eddy Sizes



### Energy Transfer Rate





# Work Experience

## Rolls Royce: R&D LCGO Combustion Turbulence Modelling

### Turbulence Modelling Functions:

- Reacting flow analysis of experimental combustor
- Turbulence modeling of combustor aerodynamics
- Investigation of flame anchoring and position
- CO and NO<sub>x</sub> emissions analysis
- LCGO: Low Cost Gas Only

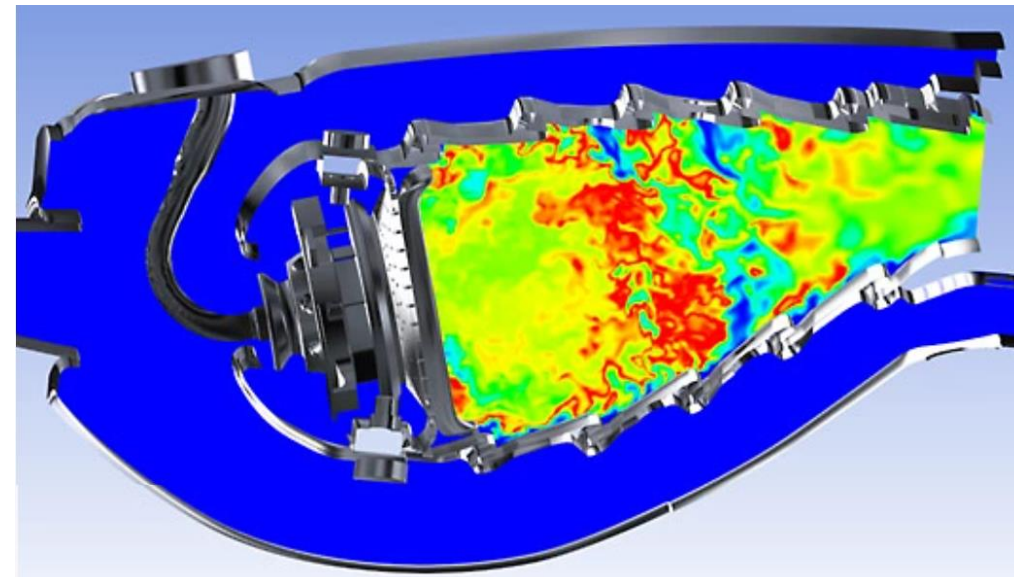
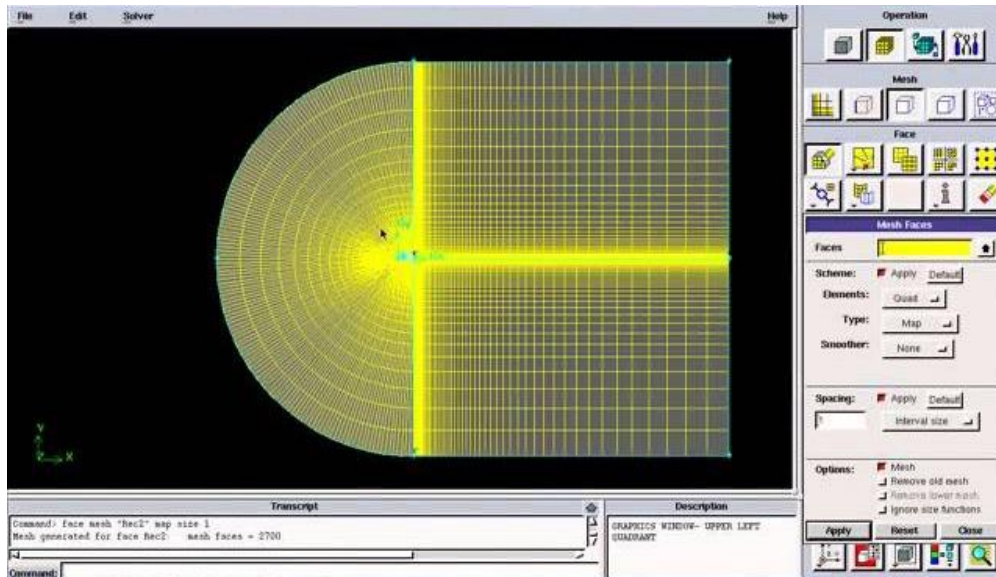


# Work Experience

## Rolls Royce: R&D LCGO Combustion Turbulence Modelling

### Turbulence Modelling Software:

- Gambit – 3D model generation and Meshing
- Fluent – 3D Turbulence Simulation



Questions?