Postgraduate Certificate

Course in Advanced CFD Techniques

tech global university

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Postgraduate Certificate
Course in Advanced CFD Techniques

- Modality: **online**
- Duration: **6 weeks**
- Certificate: **TECH Global University**
- Credits: **6 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: www.techtitute.com/us/information-technology/postgraduate-certificate/course-advanced-cfd-techniques

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01

Introduction

Advanced CFD techniques are used to analyze and simulate fluid behavior in complex situations. These techniques are applied in a wide variety of fields, from aerospace engineering to the chemical industry and medicine. One of the most advanced CFD techniques is turbulence simulation, which allows to model fluid motion in situations where flows are unstable and chaotic.For this reason, TECH Global University has designed a degree that allows students to maximize their knowledge on aspects such as the Rules of the Game, Defense, Static Phases, Training Exercises and the Offensive System, among others. All this, thanks to a 100% online modality and with the most dynamic and practical multimedia materials available in the academic market.

Learn in depth about Advanced CFD Techniques, thanks to the best online university in the world according to Forbes, thanks to TECH Global University"

Computational fluid dynamics (CFD) is a simulation tool used in a variety of fields, from aerospace to energy and civil engineering. Advanced CFD techniques enable computer scientists, engineers and computer scientists to simulate and analyze complex situations, resulting in a better understanding of physical phenomena and more efficient system design.

For this reason, TECH Global University has designed a University Postgraduate certificate in Advanced CFD Techniques to provide students with the necessary skills and competencies to be able to perform their work as specialists with the highest possible efficiency and quality. Thus, throughout this program, aspects such as Post-processing, Shape Functions, Development of Boundary Conditions, Molecular Equilibrium and Modeling will be addressed.

All this, through a convenient 100% online modality that allows students to organize their schedules and studies, combining them with their other Obligation. In addition, this degree has the most Dynamic theoretical and practical materials on the market, which facilitates the student's study process and allows them to achieve their objectives quickly and complete.

This **Postgraduate Certificate Course in Advanced CFD Techniques** contains the most complete and up-to-date educational program on the market. Its most outstanding features are:

- The development of case studies presented by experts in Advanced CFD Techniques
- The graphic, schematic and practical contents of the program provide Rehabilitation and practical information on those disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

Become an expert in DSMC Method Applicability in only 6 weeks and with total freedom of organization"

Access all content on Molecular Equilibrium, Supersonic Corner and LBM from your tablet, mobile or computer at any time of the day"

Enhance the maximum, the your professional profile in one of the most promising areas of the IT sector, thanks to TECH Global University and the most innovative materials and practice of.

Enroll now and delve into Experimentation with various Collision Operators from the comfort of your home and at any time of the day.

The program's teaching staff includes professionals from the sector who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

Its multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide an immersive education programmed to learn in real situations.

The design of this program focuses on Problem-Based Learning, by means of which the professional must try to solve the different professional practice situations that are presented throughout the academic course. For this purpose, the student will be assisted by an innovative interactive video system created by renowned experts.

02

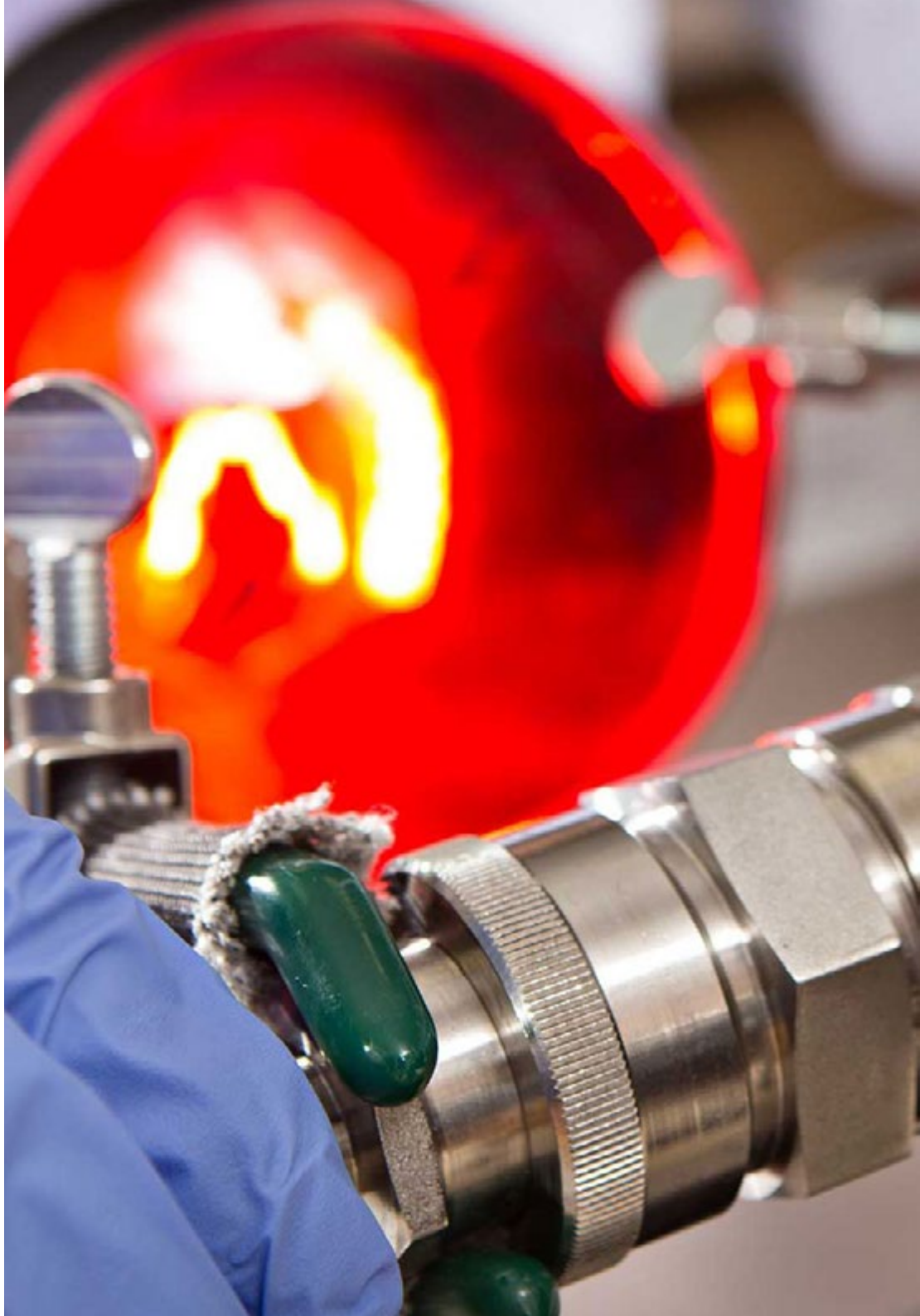
Objectives

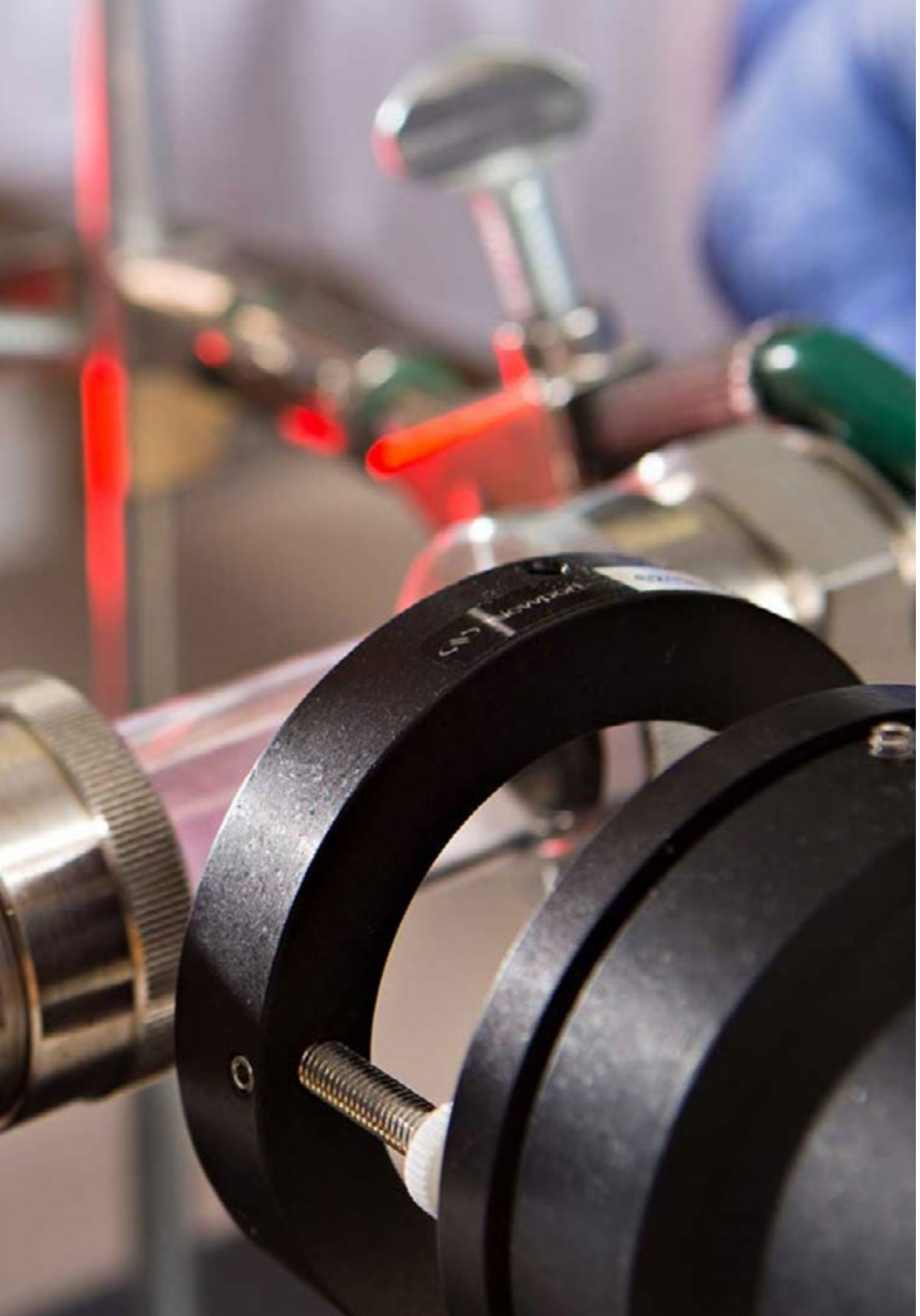
The objective Final Assessment of this University postgraduate certificate on CFD Techniques Advanced is that the student acquires a precise Foundations and update of his knowledge in this area highly relevant. An update that will allow students to work with the highest possible quality in their work. All this, thanks to TECH Global University and a 100% online modality that gives total freedom of organization and schedules to the student.

Acquire new and better knowledge about one of the areas in the IT field that will boost your professional profile on the road to success"

General Objectives

- Establish the basis for the study of turbulence
- Develop CFD statistical concepts
- Determine the main computational techniques in turbulence research
- Generate specialized knowledge in the method of Finite Volumes
- Acquire specialized knowledge in fluid mechanics calculation techniques
- Examine the wall units and the different regions of a turbulent wall flow
- Determine the characteristics of compressible flows
- Examine multiple models and multiphase methods
- Develop expertise on multiple models and methods in multi-physics and thermal analysis
- Interpret the results obtained by correct post-processing





Specific Objectives

- Develop the Finite Element Method and the Smoothed Particle Hydrodynamics Method
- Analyze the advantages of Lagrangian versus Eulerian methods, in particular, SPH vs FVM
- Analyze the Monte-Carlo Direct Simulation method and the Lattice-Boltzmann Method
- Evaluate and interpret spatial aerodynamics and micro-fluidodynamics simulations
- Establish the advantages and disadvantages of LBM versus the traditional FVM method

Achieve your most demanding objectives, thanks to a TECH Global University program that has the most complete theoretical and practical materials on CFD Techniques in the academic market"

03

Course Management

In order to provide a degree of the highest quality and usefulness, TECH Global University has selected professionals specialized in Advanced CFD Techniques as part of this teaching staff, who have been in charge of the design of the most advanced contents. Thus, you will learn from the best the keys to your professional development in a field that adapts to new technologies and the latest market advances.

Experienced management and faculty will provide you with the latest advances in Molecular Equilibrium and Statistical Mechanics, preparing you to meet any possible challenge in this area"

Management

Dr. García Galache, José Pedro

- XFlow Development Engineer at Dassault Systèmes
- Doctor in Aeronautical Engineering from the Polytechnic University of Valencia
- Degree in Aeronautical Engineering from the Polytechnic University of Valencia
- Research Master's Degree in Fluid Mechanics by the Von Kármán Institute for Fluid Dynamics
- Programa de formación breve en el Instituto Von Kármán de Dinámica de Fluidos

Professors

Dr. Espinoza Vásquez, Daniel

- Consultant Aeronautical Engineer at Alten SAU
- Freelance CFD and Programming Consultant
- CFD Specialist at Particle Analytics Ltd
- Research Assistant at the University of Strathclyde
- Teaching Assistant in Fluid Mechanics, University of Strathclyde
- D. in Aeronautical Engineering from the University of Strathclyde
- Master's degree in Computational Fluid Mechanics from Cranfield University
- Degree in Aeronautical Engineering from the Polytechnic University of Madrid

04

Structure and Content

The structure and all the didactic resources of this curriculum have been designed by the renowned professionals that make up TECH Global University team of experts in the area of Computer Science. These specialists have used their extensive experience and specialized knowledge to create practical and completely updated contents. All of this, based on the most efficient pedagogical methodology, TECH Global University Relearning.

Take advantage of the opportunity and access all content from any device with an internet connection"

Module 1. Advanced Methods for CFD

1.1. Finite Element Method (FEM)
- 1.1.1. Domain discretization. Finite Elements
- 1.1.2. Form functions. Reconstruction of the continuous field
- 1.1.3. Assembly of the coefficient matrix and boundary conditions
- 1.1.4. Solving the system of equations

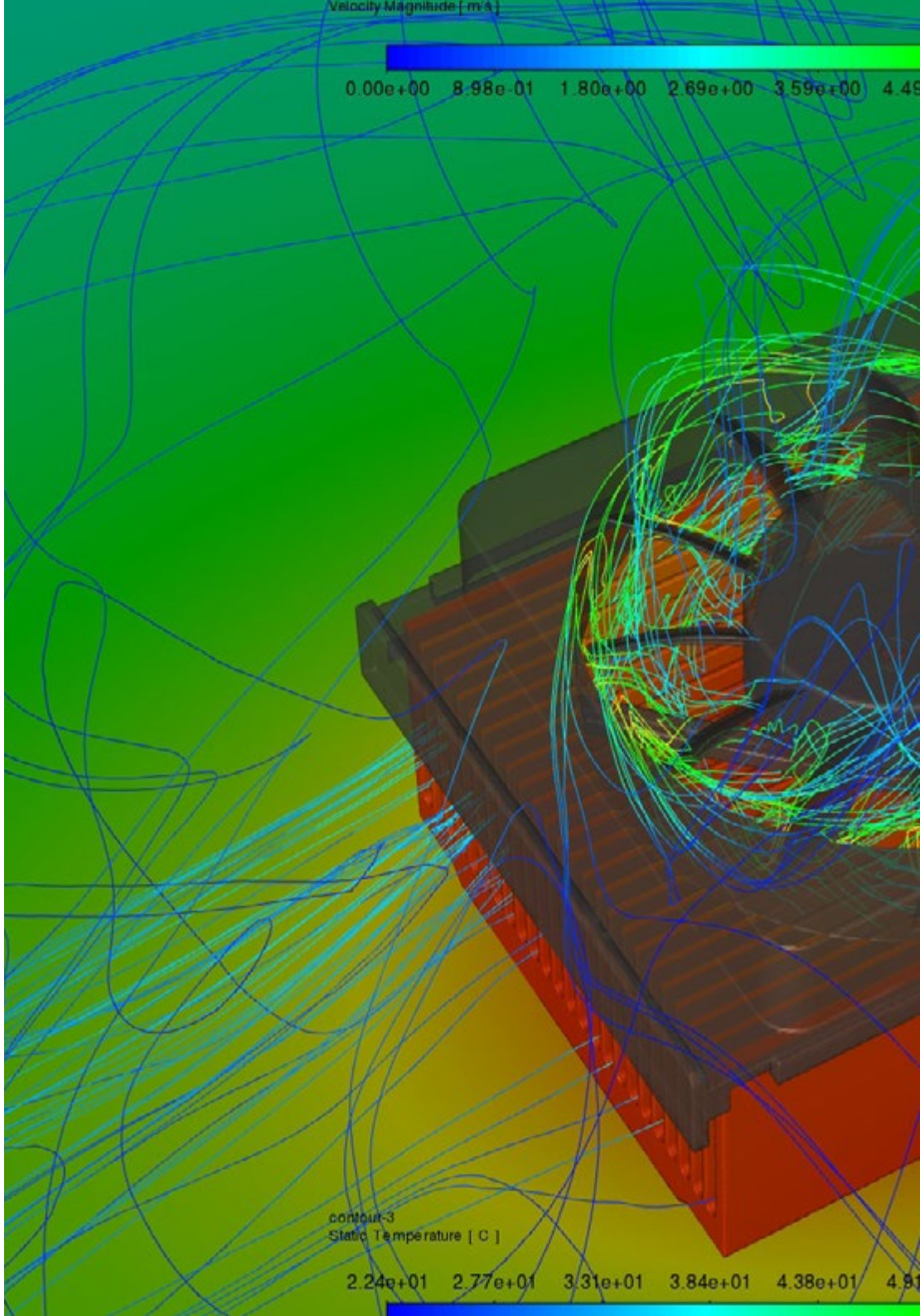
1.2. FEM Case Studies Development of a FEM simulator
- 1.2.1. Form functions
- 1.2.2. Assembling the coefficient matrix and applying boundary conditions
- 1.2.3. Solving the system of equations
- 1.2.4. Post-Process

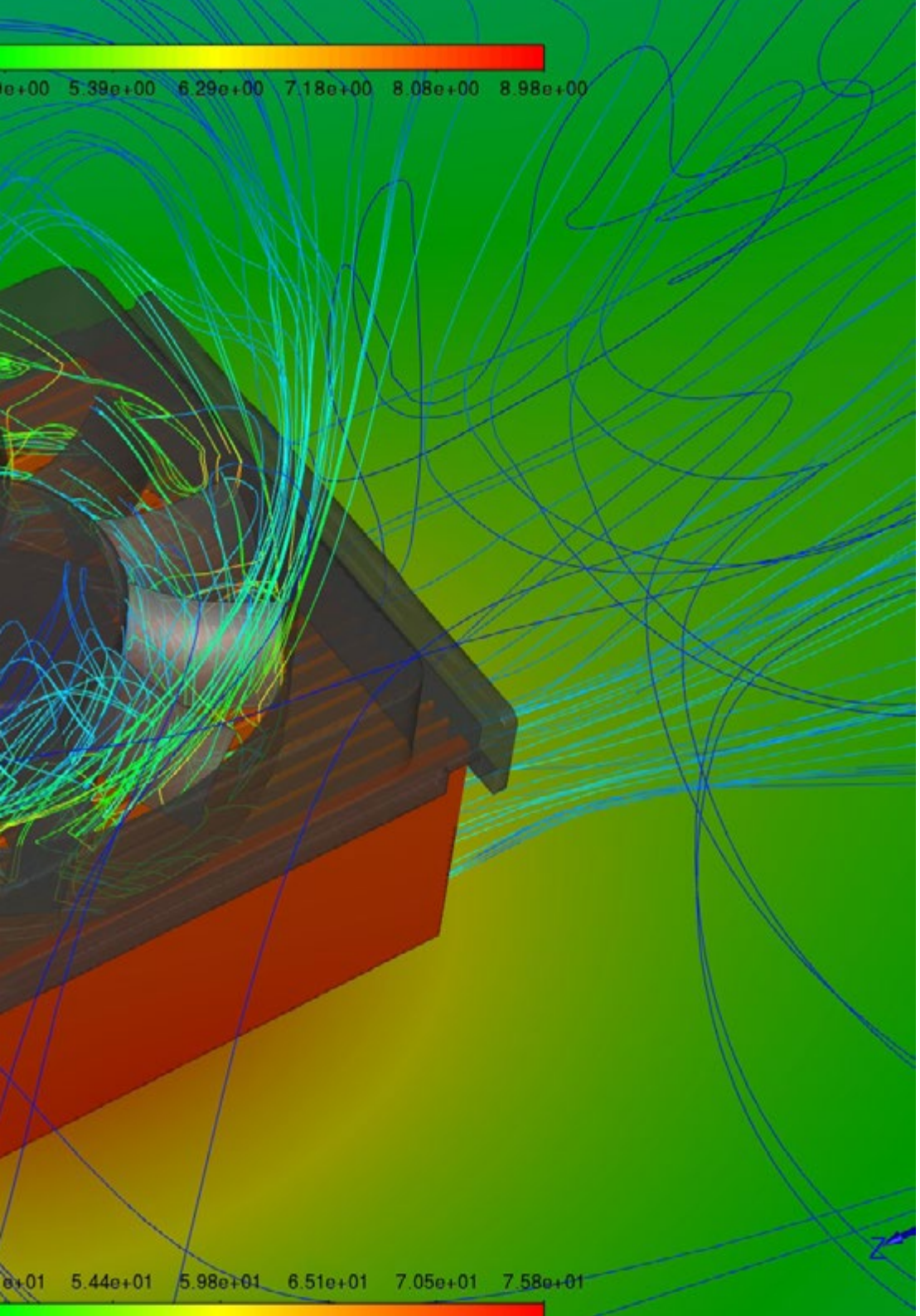
1.3. Smoothed Particle Hydrodynamics (SPH)
- 1.3.1. Fluid field mapping from particle values.
- 1.3.2. Evaluation of derivatives and particle interaction
- 1.3.3. The smoothing function. The kernel
- 1.3.4. Boundary Conditions

1.4. SPH: Development of a simulator based on SPH
- 1.4.1. The kernel
- 1.4.2. Storage and sorting of particles in voxels
- 1.4.3. Development of boundary conditions
- 1.4.4. Post-Process

1.5. Direct Simulation Monte Carlo (DSMC)
- 1.5.1. Kinetic-molecular theory
- 1.5.2. Statistical mechanics
- 1.5.3. Molecular equilibrium

1.6. DSMC: Methodology
- 1.6.1. Applicability of the DSMC method
- 1.6.2. Modeling
- 1.6.3. Considerations for the applicability of the method





1.7. DSMC: Applications
- 1.7.1. Example in 0-D: Thermal relaxation
- 1.7.2. Example in 1-D: Normal shock wave
- 1.7.3. Example in 2-D: Supersonic cylinder
- 1.7.4. Example in 3-D: Supersonic corner
- 1.7.5. Complex example: Space Shuttle

1.8. Lattice-Boltzmann Method (LBM)
- 1.8.1. Boltzmann equation and equilibrium distribution
- 1.8.2. De Boltzmann a Navier-Stokes. Chapman-Enskog Expansion
- 1.8.3. From probabilistic distribution to physical magnitude
- 1.8.4. Conversion of units. From physical quantities to lattice quantities

1.9. LBM: Numerical approximation
- 1.9.1. The LBM Algorithm. Transfer step and collision step
- 1.9.2. Collision operators and momentum normalization
- 1.9.3. Boundary Conditions

1.10. LBM: Case Study
- 1.10.1. Development of a simulator based on LBM
- 1.10.2. Experimentation with various collision operators
- 1.10.3. Experimentation with various turbulence models

Test your new skills on Advanced CFD Techniques, thanks to the most challenging and instructive hands-on activities"

05

Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning.**

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"

You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.

The student will learn to solve complex situations in real business environments through collaborative activities and real cases.

A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

> *Our program prepares you to face new challenges in uncertain environments and achieve success in your career"*

The case method has been the most widely used learning system among the world's leading Information Technology schools for as long as they have existed. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the course, students will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

Relearning Methodology

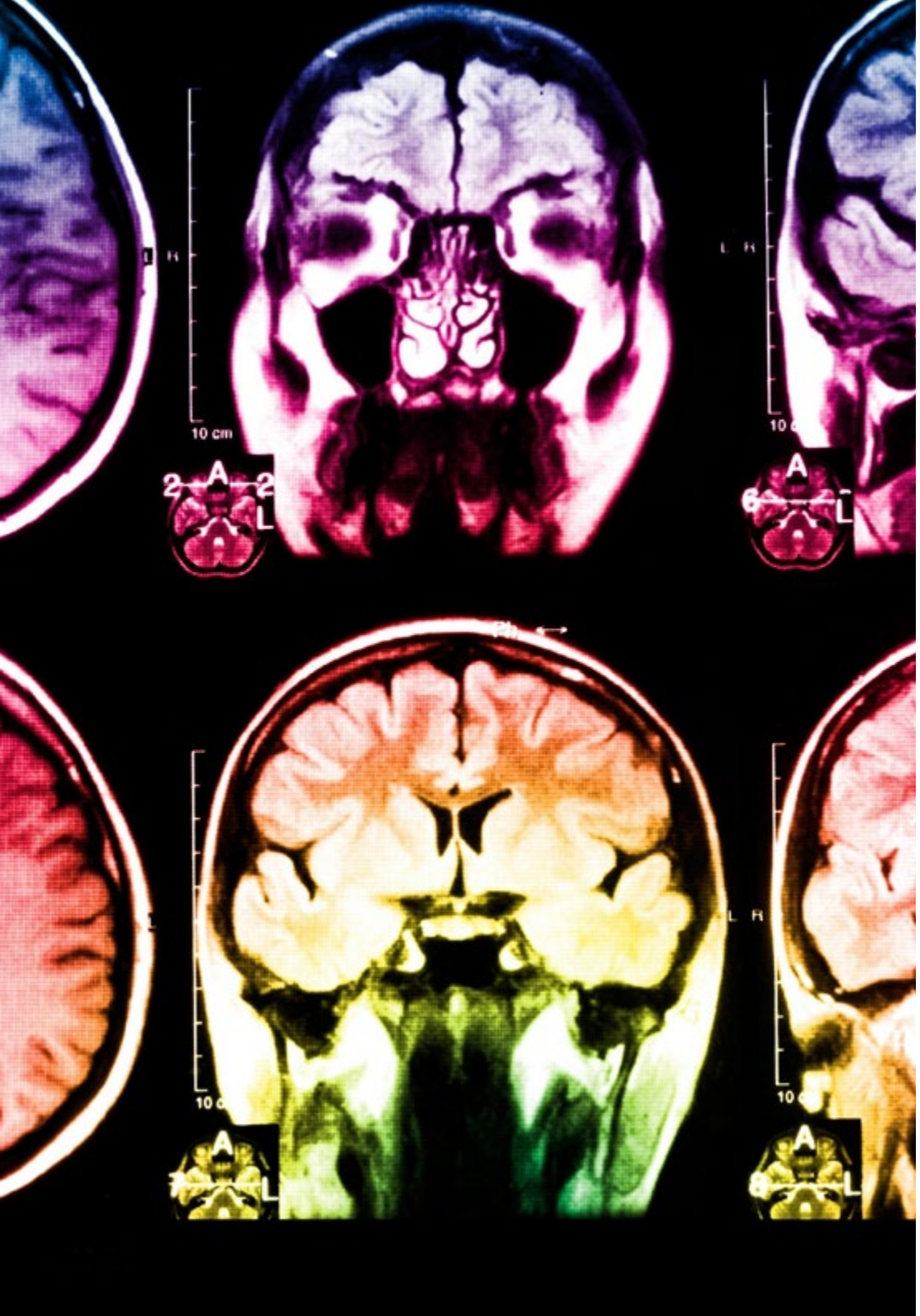
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

In 2019, we obtained the best learning results of all online universities in the world.

At TECH you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.

This program offers the best educational material, prepared with professionals in mind:

Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.

Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

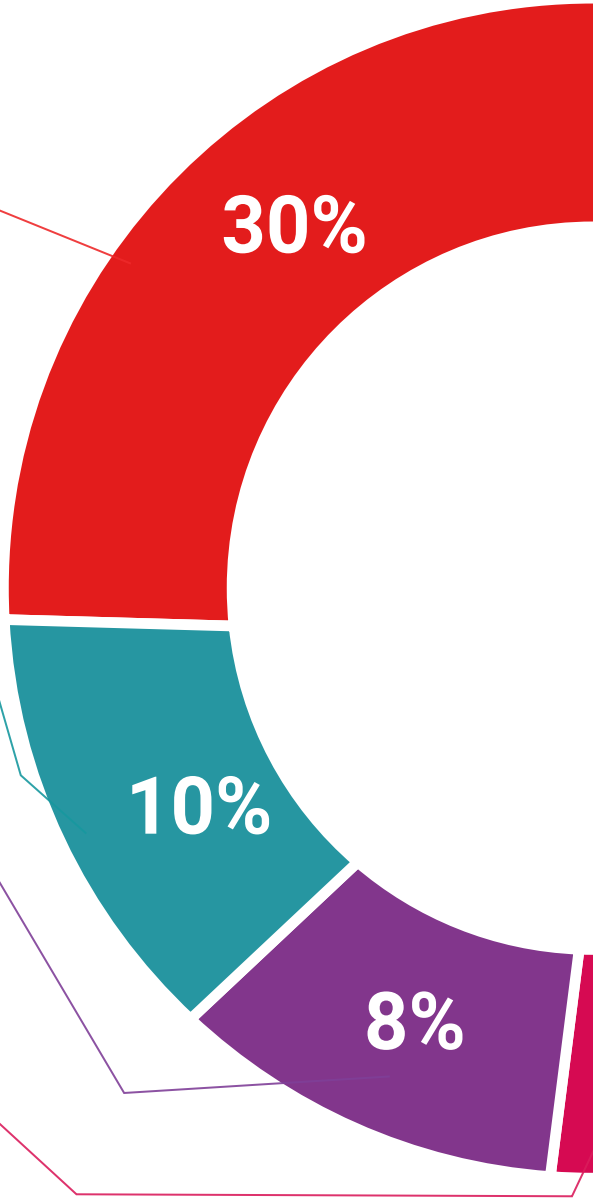
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

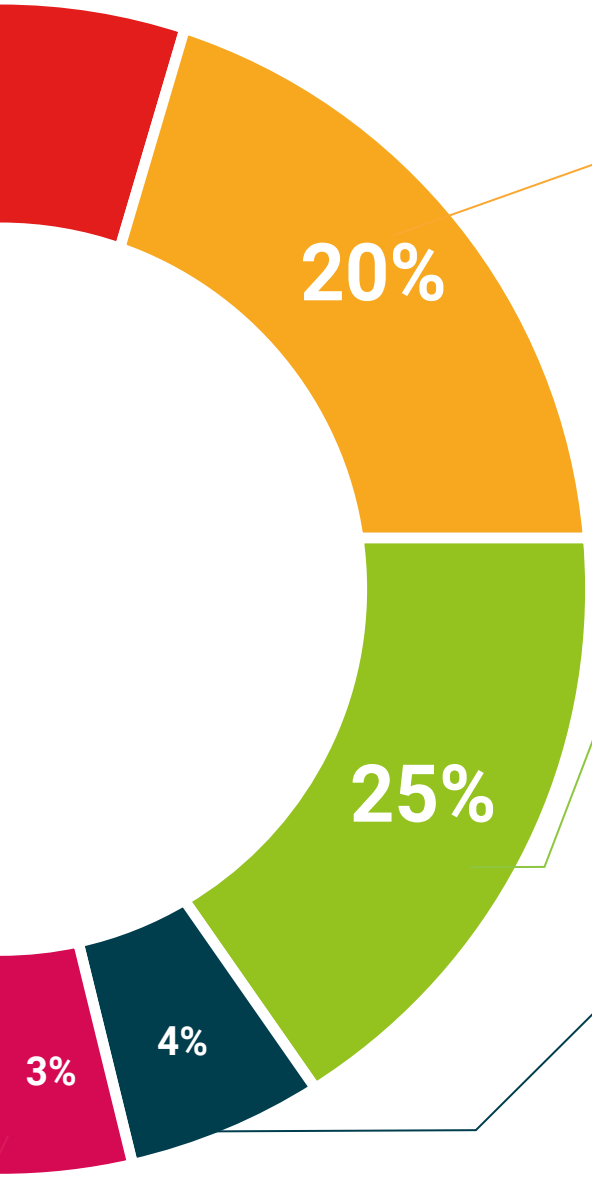
Practising Skills and Abilities

They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.

Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.

Interactive Summaries

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".

Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.

06

Certificate

The Postgraduate Certificate Course in Advanced CFD Techniques guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Global University.

Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"

This program will allow you to obtain your **Postgraduate Certificate in Course in Advanced CFD Techniques** endorsed by **TECH Global University**, the world's largest online university.

TECH Global University is an official European University publicly recognized by the Government of Andorra (***official bulletin***). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Postgraduate Certificate in Course in Advanced CFD Techniques**

Modality: **online**

Duration: **6 weeks**

Accreditation: **6 ECTS**

tech global university

Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

Postgraduate Certificate in Course in Advanced CFD Techniques

This is a program of 180 hours of duration equivalent to 6 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February of 2024

Dr. Pedro Navarro Illana
Rector

Unique TECH Code: AFWORD23S techtitute.com/certificates

*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH Global University will make the necessary arrangements to obtain it, at an additional cost.

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Postgraduate Certificate
Course in Advanced CFD Techniques

- Modality: **online**
- Duration: **6 weeks**
- Certificate: **TECH Global University**
- Credits: **6 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Postgraduate Certificate

Course in Advanced CFD Techniques

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