Postgraduate Certificate
Advanced CFD Techniques

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Postgraduate Certificate
Advanced CFD Techniques

- Modality: **online**
- Duration: **6 weeks**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/pk/engineering/postgraduate-certificate/advanced-cfd-techniques**

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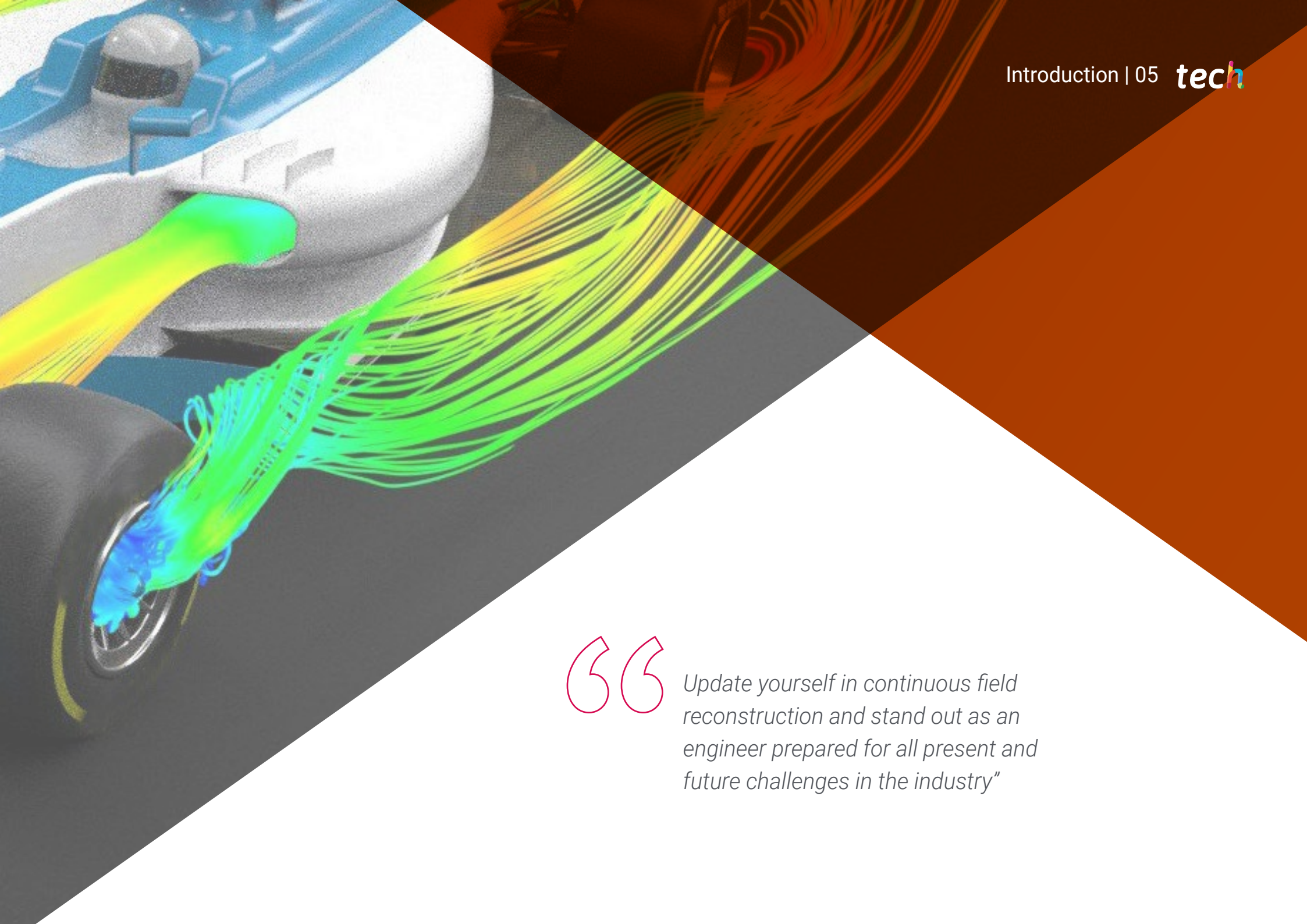
01

Introduction

Computational Fluid Dynamics (CFD) techniques are essential in many industries, such as aeronautics, automotive, energy, shipbuilding and construction. Therefore, these sectors require engineers highly skilled in advanced CFD techniques to design, analyze and optimize complex systems and devices. Thus, the demand for engineers trained in advanced CFD techniques is constantly growing, opening up a wide range of job opportunities in various sectors. Thus, TECH has created this 100% online academic degree in order to provide professionals with the necessary skills and tools to carry out fluid field mapping from particle values.



Update yourself in continuous field reconstruction and stand out as an engineer prepared for all present and future challenges in the industry"

Advanced CFD Techniques are fundamental in solving engineering problems in different fields such as aerospace, automotive, energy, among others. Professionals trained in these techniques can design and analyze systems and devices with greater efficiency and accuracy, resulting in reduced costs and greater environmental sustainability, evidencing a growing need for experts in advanced CFD techniques to meet the demands of the industry.

In response to this growing demand, TECH has developed this program. It is a degree designed to provide a multidisciplinary and practical teaching in the application of Advanced CFD Techniques to problems. With it, graduates will acquire skills to analyze and solve complex problems in different areas of engineering, which will allow them to be more competitive in the labor market.

In addition, this program is taught in a 100% online format, which allows students to combine this learning with other activities and responsibilities. Likewise, the teaching methodology used is Relearning, which is based on the constant repetition of the most important concepts throughout the syllabus in order to achieve a natural and holistic integration of knowledge.So that graduates will be better prepared to apply advanced CFD techniques in the real world efficiently and dynamically. CFD techniques in the real world in an efficient and dynamic way.

This **Postgraduate Certificate 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 Textile Engineering
- The graphic, schematic, and practical contents with which they are created, provide practical information on the disciplines that are essential for professional practice
- Practical exercises where the process of 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

Give a significant boost to your professional career by including this Diploma in your CV”

Decide how to distribute the entire teaching load, without having to adhere to complicated schedules or attend face-to-face classes”

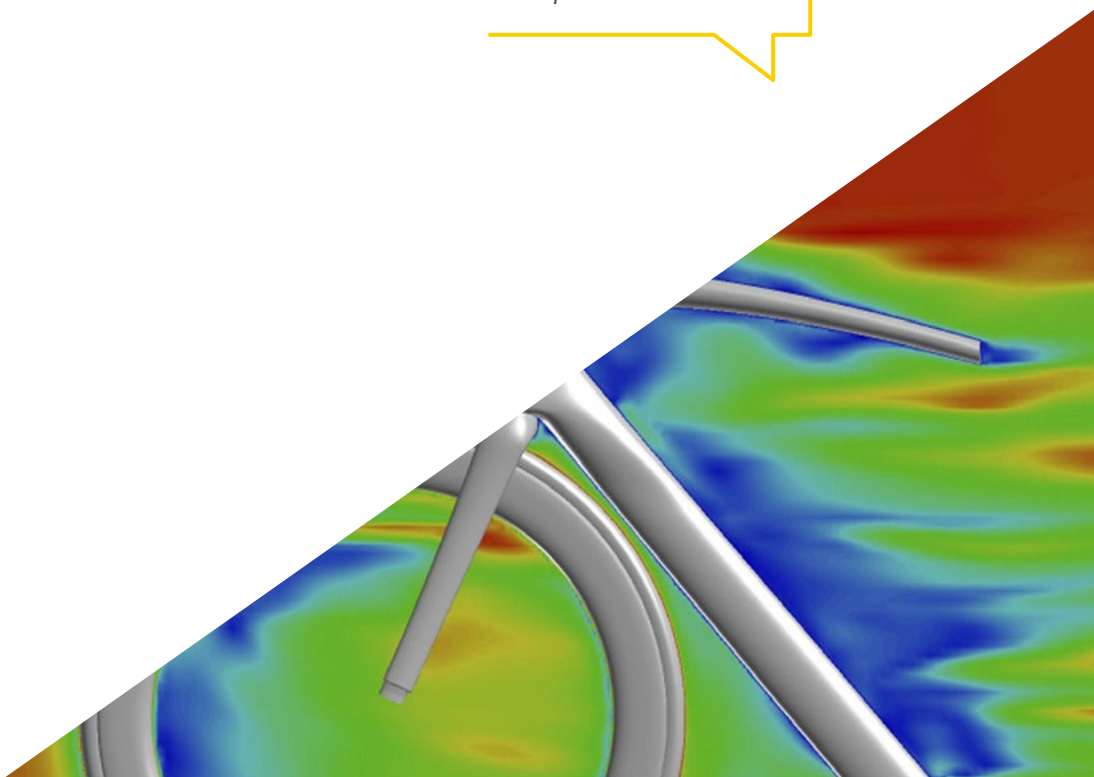
Learn more about smoothed particle hydrodynamics and become fluent in this TECH academic program.

Access a syllabus rich in content, where you will find a multitude of real examples and practical analysis that contextualize the topics covered.

The program’s teaching staff includes professionals from 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.

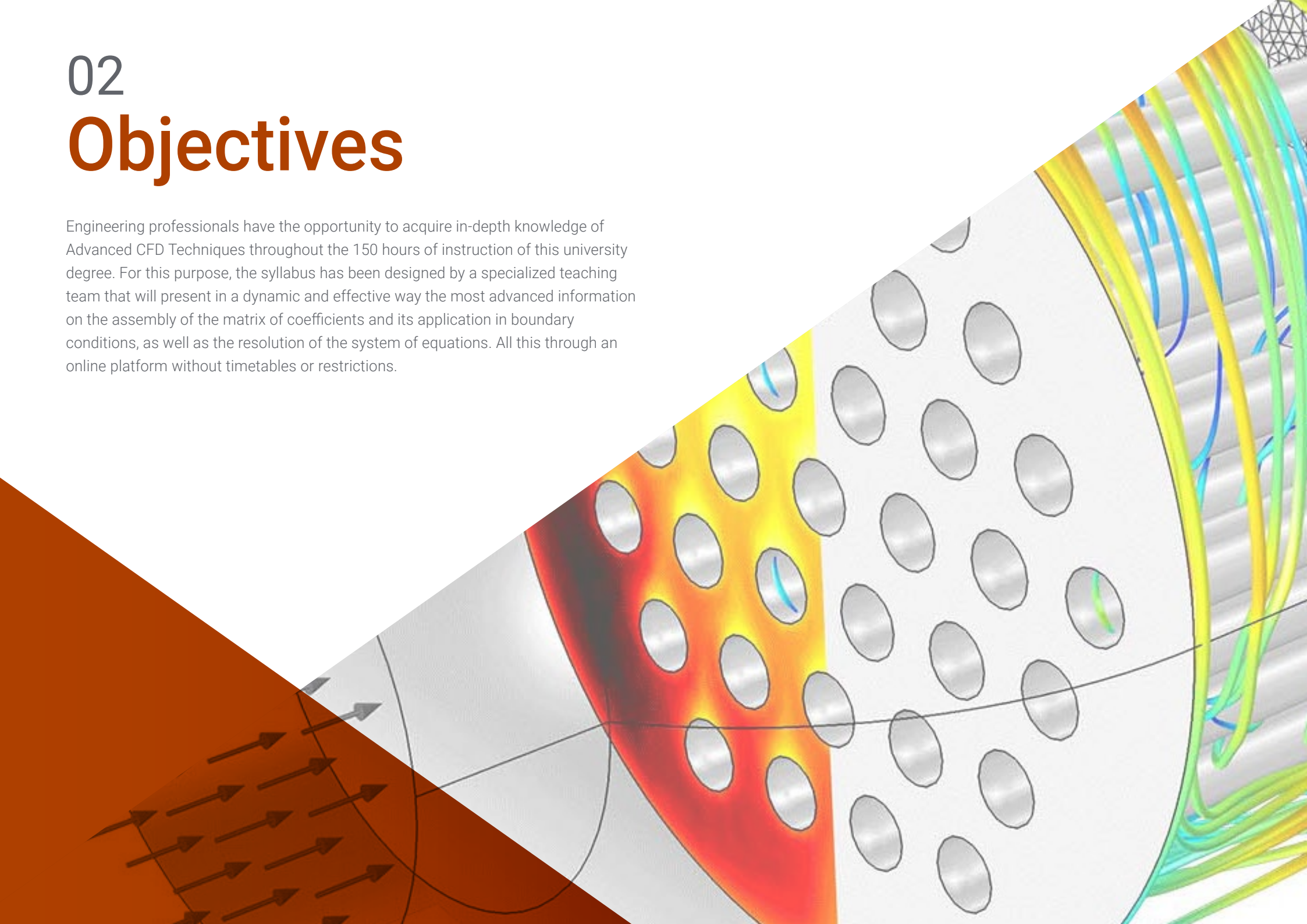
The design of this program focuses on Problem-Based Learning, by means of which the professional must try to solve the different professional practice situations that are presented throughout the academic course. For this purpose, the student will be assisted by an innovative interactive video system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

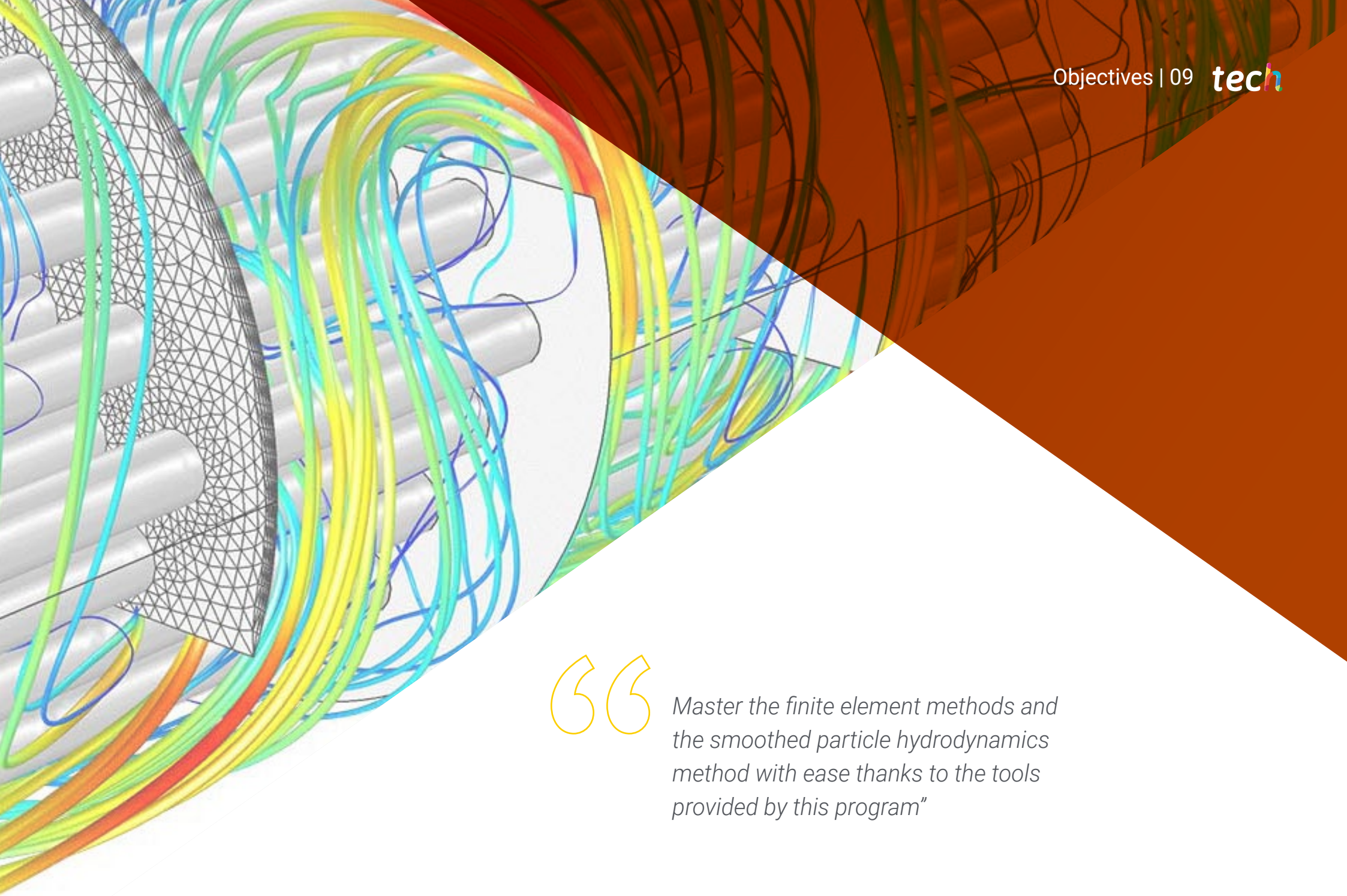


02

Objectives

Engineering professionals have the opportunity to acquire in-depth knowledge of Advanced CFD Techniques throughout the 150 hours of instruction of this university degree. For this purpose, the syllabus has been designed by a specialized teaching team that will present in a dynamic and effective way the most advanced information on the assembly of the matrix of coefficients and its application in boundary conditions, as well as the resolution of the system of equations. All this through an online platform without timetables or restrictions.

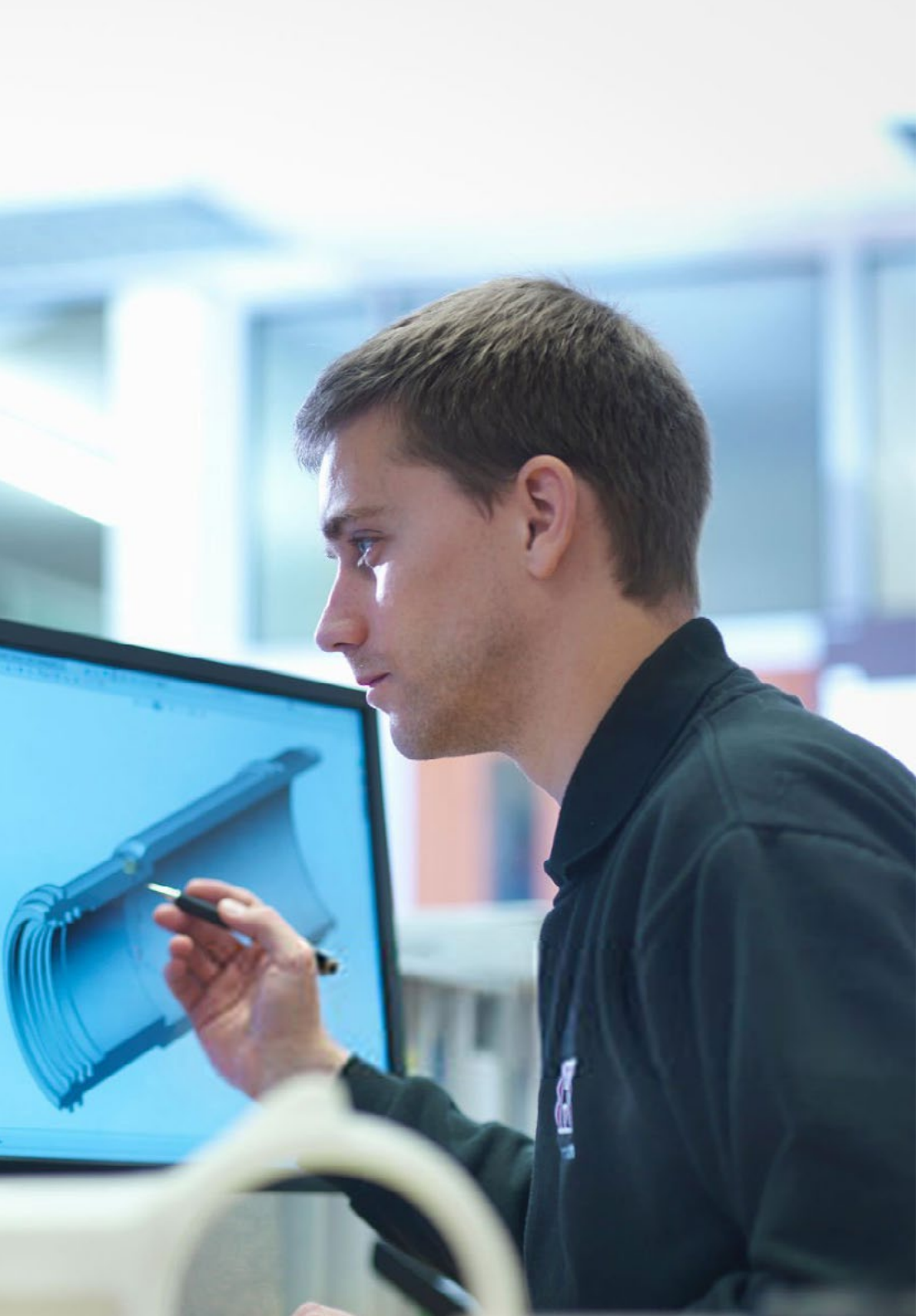




Master the finite element methods and the smoothed particle hydrodynamics method with ease thanks to the tools provided by this program”

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 the multiple models and methods in multiphysics 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 microfluid dynamics simulations
- Establish the advantages and disadvantages of LBM versus the traditional FVM method

Achieve your most ambitious career goals with a university degree that will take you to the forefront of engineering"

03

Course Management

Aware of the need for experienced professionals in the area to guide the student, TECH has carefully selected the faculty for this program. Thus, it has brought together highly qualified experts with extensive careers in the area of Computational Fluid Mechanics. This ensures that engineers will have access to the most innovative and relevant content in the sector, through the most effective teaching methodology, TECH Relearning.

Develop the most important and in-demand skills in your sector, supported by the best didactic and academic content created by the most renowned experts"

Management

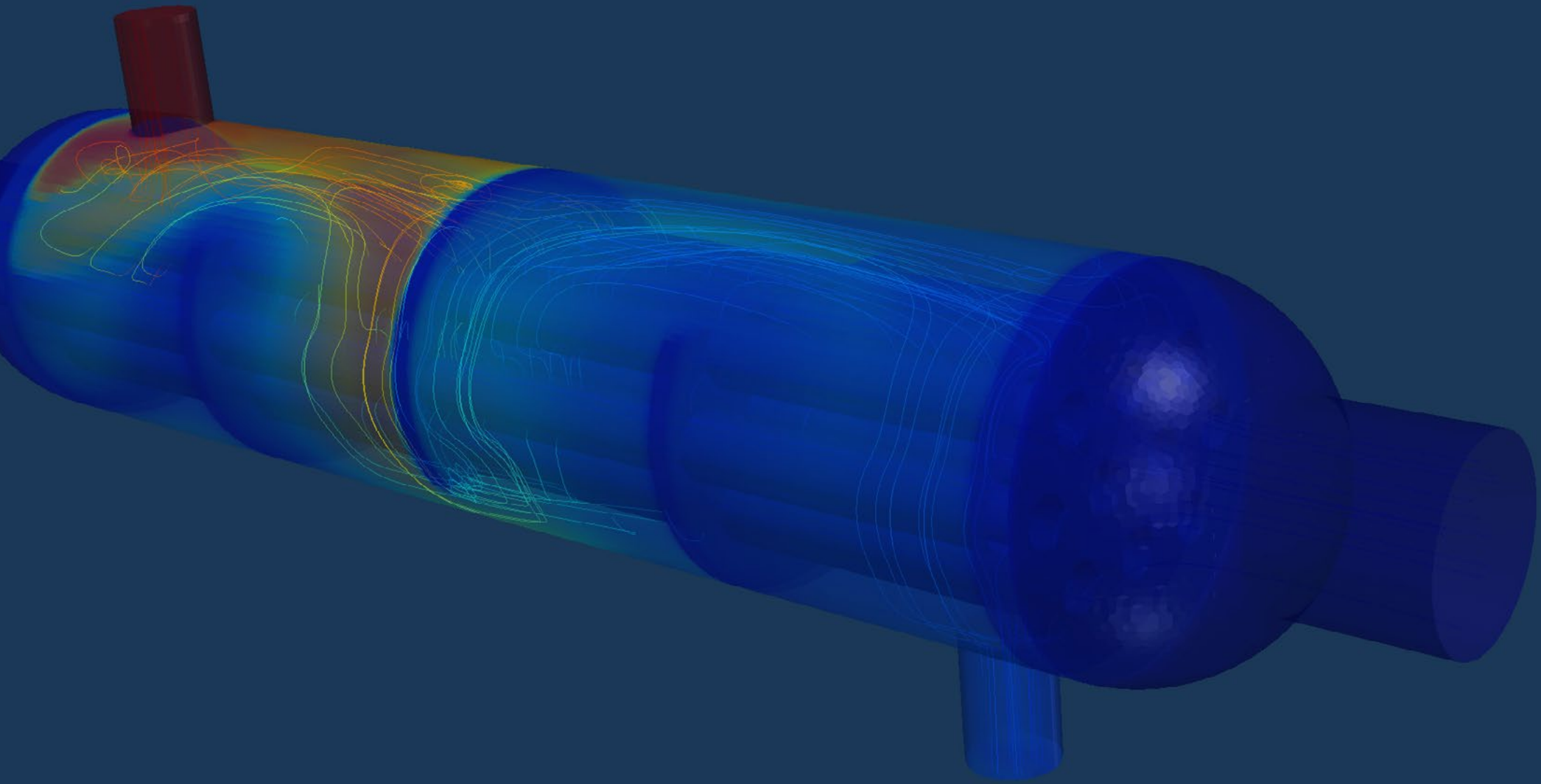
Dr. José Pedro García Galache

- XFlow Development Engineer at Dassault Systèmes
- PhD in Aeronautical Engineering from the Polytechnic University of Valencia
- Degree in Aeronautical Engineering from the Polytechnic University of Valencia
- Master's Degree in Research in Fluid Mechanics from the Von Kármán Institute for Fluid Dynamics
- Short Training Program in the Von Kármán Institute for Fluid Dynamics

Professors

Dr. Daniel Espinoza Vásquez

- 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
- Dr. in Aeronautical Engineering from the University of Strathclyde
- Master's Degree in Computational Fluid Mechanics, Cranfield University
- Degree in Aeronautical Engineering from Universidad Politécnica de Madrid



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Structure and Content

This TECH academic degree is based on the Relearning methodology, which involves the reiteration of key concepts throughout the syllabus to achieve a natural integration of knowledge. With this methodology, graduates can acquire specific skills and competencies efficiently and dynamically, without the need to invest time in the tedious task of memorization. In addition, the program is delivered completely online and has the most complete and up-to-date theoretical and practical content available in the digital education market, allowing the student to delve deeper into advanced CFD methods.

You will have access to a multitude of complementary readings with which to expand your knowledge in the most relevant areas of Advanced CFD Techniques"

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 Systems 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 Systems 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

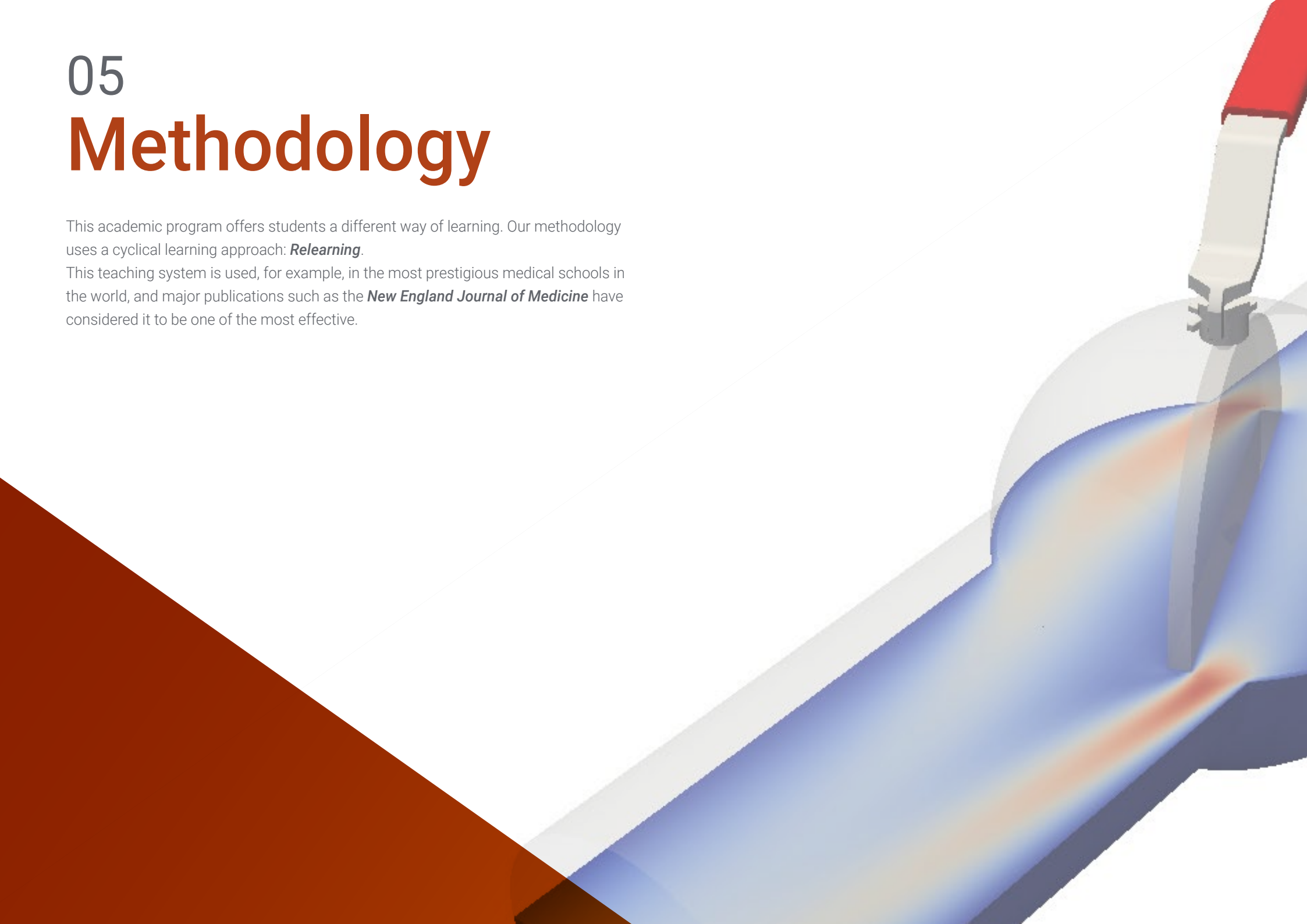
You will have 24-hour access to all the content of the Online Campus, giving you the flexibility you need to adapt it to your own pace”

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.

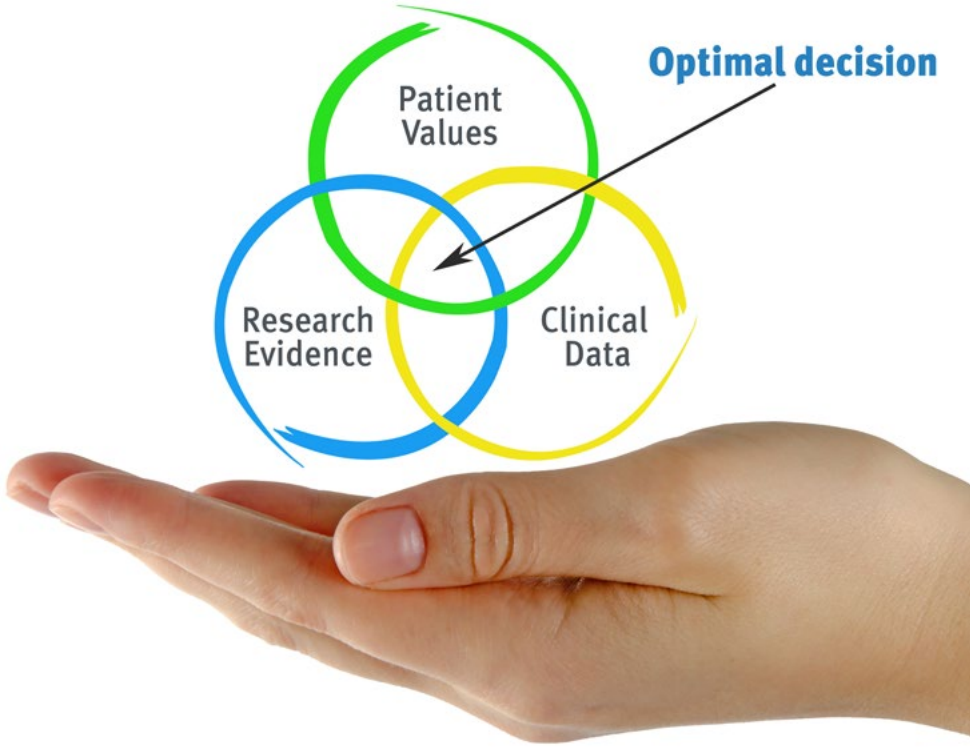


Discover Relearning, a system that abandons conventional linear learning to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

Case Study to contextualize all content

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

At TECH, you will experience a way of learning 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 is the most widely used learning system in the best faculties in the world. 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 program, the 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

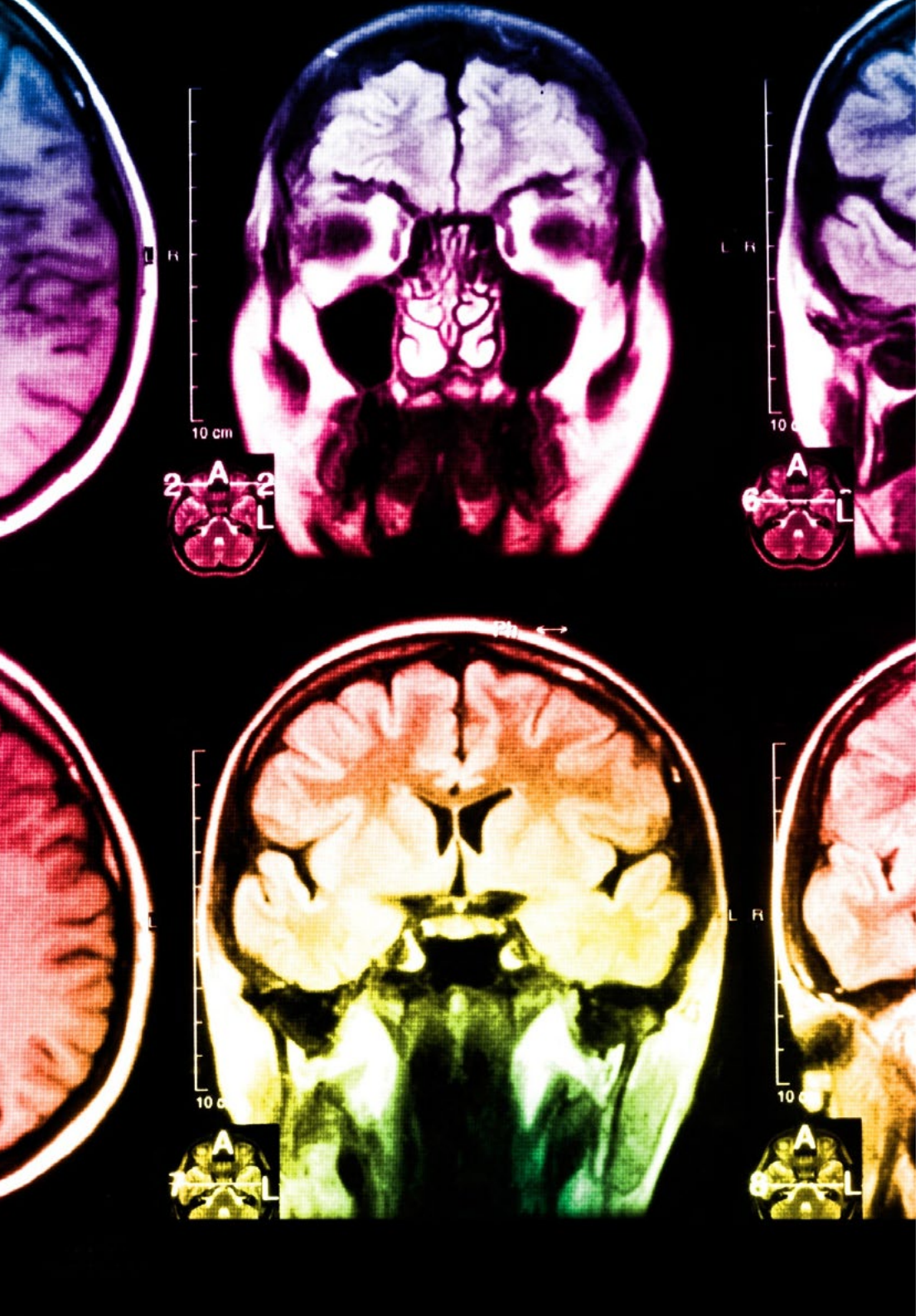
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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 prepare 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 prepared 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 education, 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 adapted in 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.

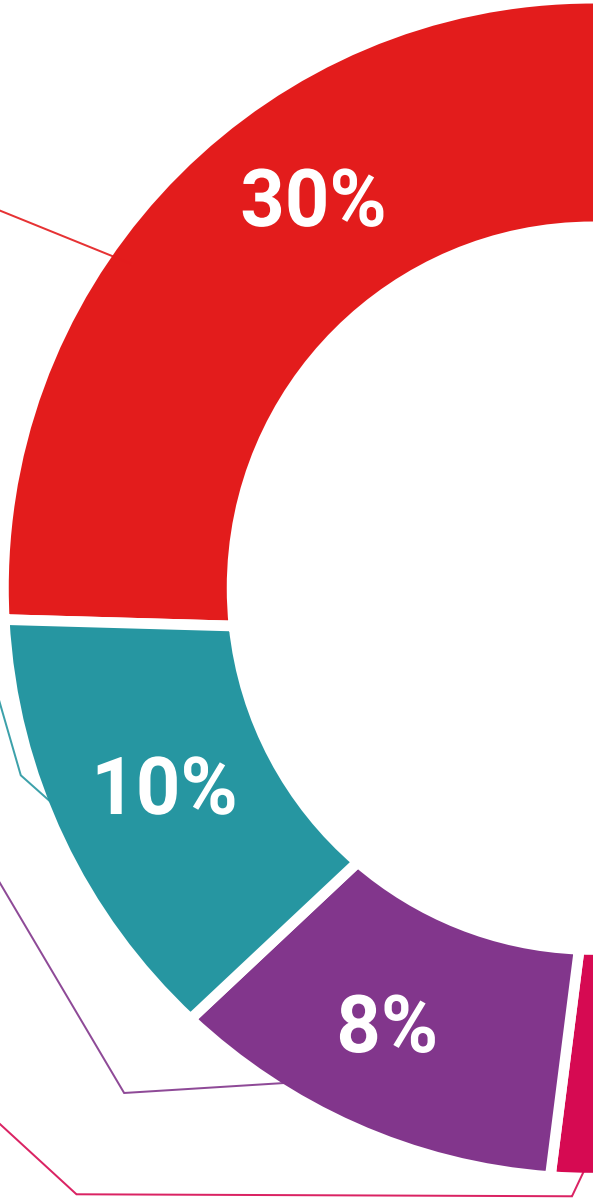
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

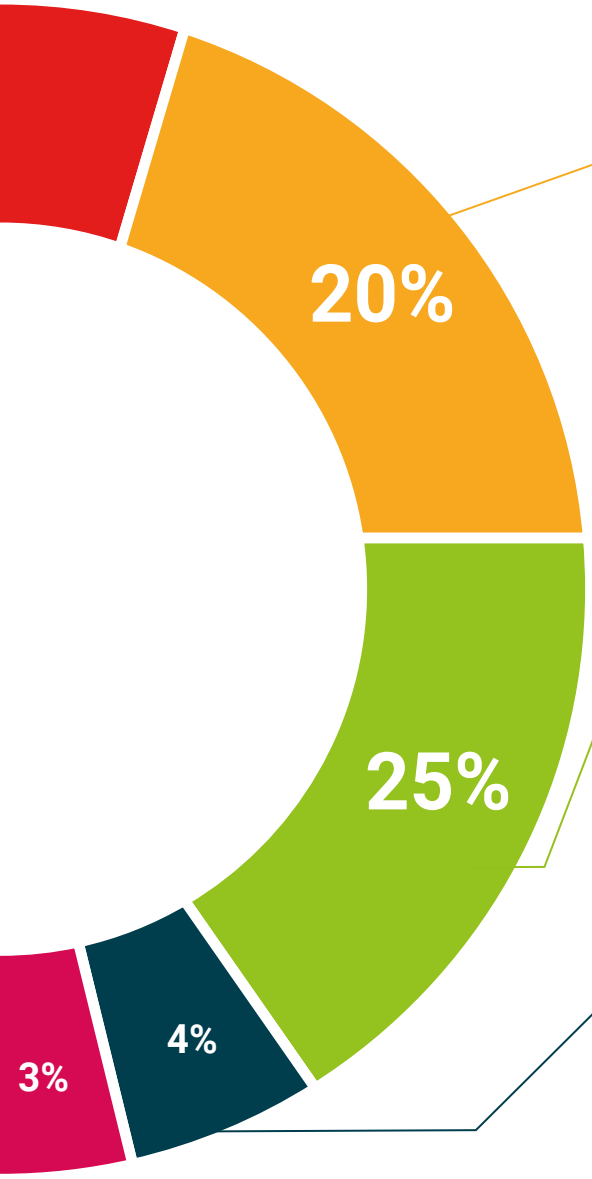
Practising Skills and Abilities

They will carry out activities to develop specific competencies and skills in each thematic field. 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 assess and re-assess 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 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 Technological University.

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

This **Postgraduate Certificate in Advanced CFD Techniques** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their correspondin **Postgraduate Certificate** issued by **TECH Technological University** via tracked delivery*.

The certificate issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Certificate, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Program: **Postgraduate Certificate in Advanced CFD Techniques**

Official Nº of Hours: **150 h.**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Awards the following

CERTIFICATE

to

Mr./Ms. _____, with identification number _____.

For having passed and accredited the following program

POSTGRADUATE CERTIFICATE

in

Advanced CFD Techniques

This is a qualification awarded by this University, equivalent to 150 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro

Dean

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates

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

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- Modality: **online**
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Postgraduate Certificate
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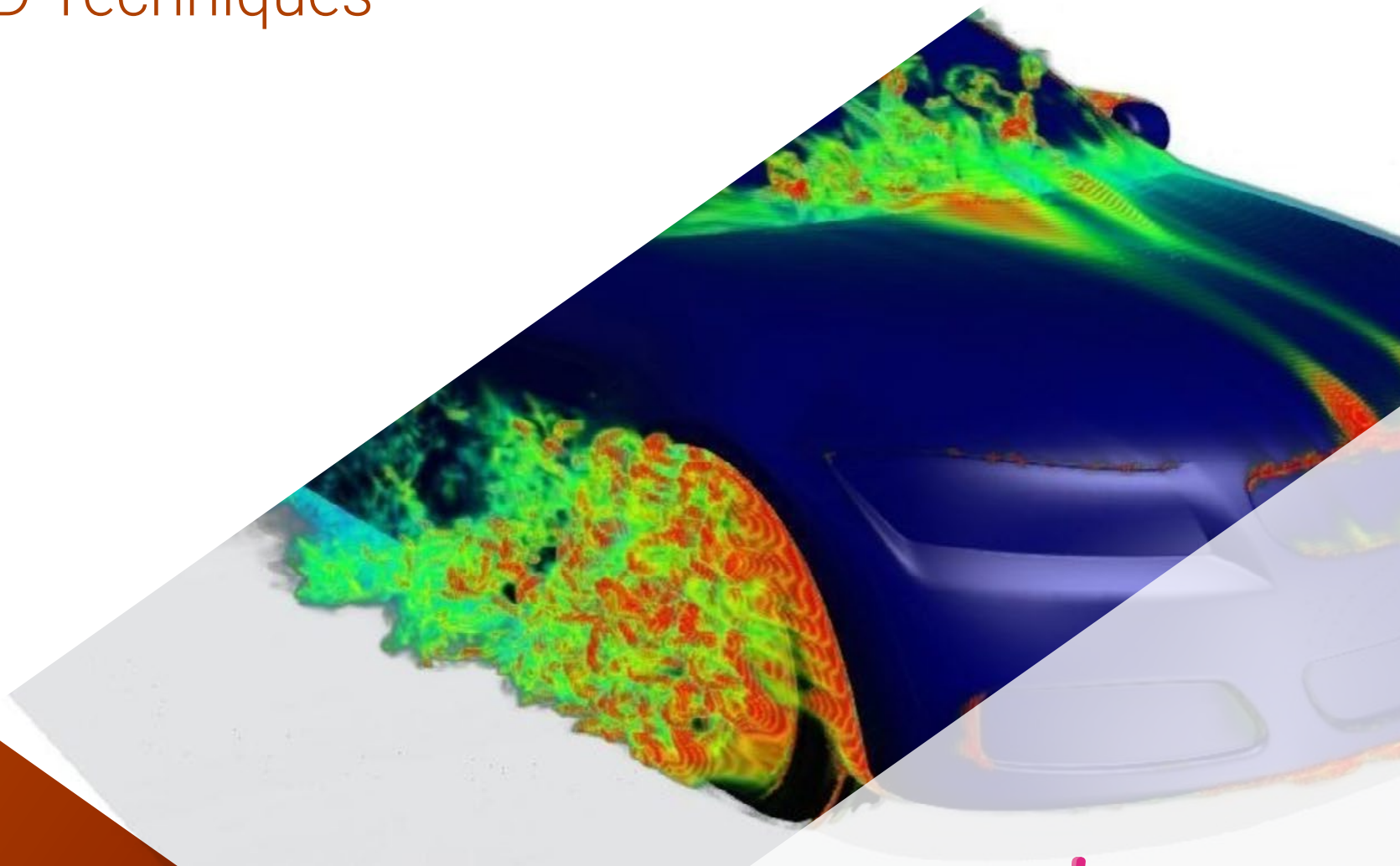

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