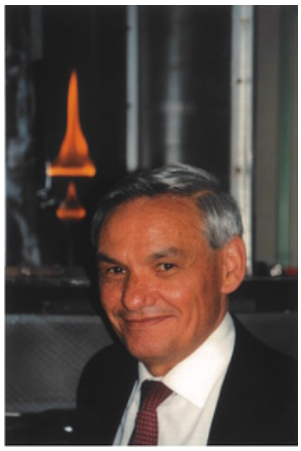
In Memoriam

Amable Liñán Martínez
(1934 - 2025)



Amable Liñán Martínez, who was born on November 27, 1934, in Noceda (León), Spain, died in Madrid on November 8, 2025, at the age of 90 from complications arising from a cardiac condition. He is survived by his wife Rosita and by his children Nacho, Javier, and Ana, along with their partners and four grandchildren.

Liñán was a leading theoretician in the fields of Combustion and Fluid Mechanics. He was educated in Aeronautical Engineering at the Escuela Técnica Superior de Ingenieros Aeronáuticos (ETSIA) of the Universidad Politécnica de Madrid (1955-1960). During his final two undergraduate years, he combined his coursework with an internship at the Instituto Nacional de Técnica Aeroespacial (INTA), where he began his research in the combustion group led by Gregorio Millán, then a close collaborator of Theodore von Kármán. Upon graduation, he received a NASA-ESRO Fellowship to pursue graduate studies at Caltech (1962-1963), where he worked under Frank Marble. Reflecting on his early career, Liñán often expressed gratitude that, within just a couple of decades, he had gone from a medieval-like life in a remote village in northern Spain, where his home had neither electricity nor running water, to witnessing firsthand the rapid scientific progress unfolding in the United States during the space race.

Upon his return to Spain, he became a Research Engineer at INTA, where he worked while completing his doctoral studies under the guidance of Gregorio Millán, who suggested diffusion flames as a research topic, resulting in a Doctorate of Engineering at Universidad Politécnica de Madrid, recorded in 1966. In 1965, he was appointed Professor of Fluid Mechanics at the ETSIA, where he taught until his retirement in 2005. Over the course of his career, he also held temporary academic appointments at the University of Michigan, where he was a Visiting Professor in the Department of Aerospace Engineering (August 1973-March 1974), and at Yale University, where he served as Adjunct Professor of Mechanical Engineering (1997-2012). He particularly enjoyed his short research stays at various institutions, including the Université de Marseille, Princeton University, Université Pierre et Marie Curie (Paris), Stanford University, and UC San Diego,

where he spent many summers with his family beginning in 1973. Although he was offered permanent positions at several U.S. institutions, he chose to remain in Spain, where he played a central role in educating three generations of Spanish fluid mechanicians.

Liñán's contributions to combustion theory were profound and transformative, placing him among the very few who have reshaped the field. It was during his stay at Caltech in the early 1960s that he was first introduced to the ideas and applications of perturbation methods, which were being developed at the time by a group of applied mathematicians, including Paco Lagerstrom, for whom Liñán expressed appreciable respect. Liñán's early exposure to these asymptotic techniques proved fundamental to his subsequent research. Notably, Liñán is largely responsible for putting the method of activation-energy asymptotics on a firm mathematical basis, building on the intuitive ideas presented in the seminal works of Zel'dovich, Frank-Kamenetskii, and others from the Russian school. Through his masterful analyses and pedagogical writing, spanning over sixty years, Liñán taught the combustion community how to systematically exploit the disparity of time and length scales commonly present in chemically reacting flows to simplify their mathematical descriptions. In these efforts, he collaborated with a group of international colleagues, including his close friends Grisha Sivashinsky from Israel, Paul Clavin and Guy Joulin from France, Norbert Peters from Germany, and one of us (FAW) from the US. Together, they introduced asymptotic methods for partial differential equations to the combustion community, fundamentally transforming the mathematical analysis of combustion science. That transformation could not have occurred without Liñán's leading contributions.

Liñán worked on a wide range of combustion problems. He applied the fundamental ideas of asymptotic expansion for large activation energies in finite-rate combustion processes to the analysis of numerous topics, including diffusion-flame structure and extinction, solid-propellant ignition, monopropellant liquid-droplet combustion, ignition in heterogeneous catalysis, solid-propellant combustion instability, diffusion-flame anchoring, lift-off and blowoff phenomena, and flame-spread processes. His landmark 1974 publication, 'The Asymptotic Structure of Counterflow Diffusion Flames for Large Activation Energies', published in Acta Astronautica, is arguably the most seminal paper in combustion theory of the past sixty years.

His research activity, however, extended far beyond activation-energy asymptotics. He employed asymptotic ideas based on time-scale disparity to make notable advances in the development of reduced chemical kinetics for combustion systems—including both hydrogen and hydrocarbon mechanisms—with important applications to turbulent-combustion modeling. This work significantly deepened our understanding of the chemical pathways governing combustion. He also made substantial contributions to the study of spray flames, carbon-particle combustion, cool flames, and the ignition of gaseous mixtures by radiant-energy deposition.

Not all of his seminal contributions were combustion-related; many were purely fluid-mechanical. Among the areas that come immediately to mind are trailing-edge triple-deck problems, spherical gas expansion from ablation sources, cavitation, chaos in a toroidal thermosyphon, compressible flow in thin channels with wall injection, and a variety of laminar-jet flows, including submerged and swirling jets. In all of this work, he brought to bear his deep physical insight and extraordinary mathematical skill, clarifying with remarkable simplicity exactly what is essential in each problem.

His research work earned him numerous awards and distinctions. He was a member of the Royal Academy of Sciences and the Royal Academy of Engineering of Spain, an Associate Member of the French Academy of Sciences, and a foreign member of the U.S. National Academy of Engineering. In addition, he was a Fellow of both the British Institute of Physics and the American Physical Society. He received the Zel'dovich Gold Medal from the Combustion Institute (1994) and the Príncipe de Asturias Prize for Scientific Research (1993), the highest scientific distinction awarded in Spain. He was also awarded honorary degrees by six Spanish universities.

The remarkable impact of Liñán's research was matched by his teaching and personal interactions. He was an enthusiastic communicator, capable of captivating any audience, from scientific experts to undergraduate students. His last public presentation, delivered at the Instituto Cervantes de Madrid on October 30, 2025, took place just a few days before his passing. His legendary patience in explaining and illustrating even the most intricate concepts was complemented by his generosity in dedicating time to others. Students at ETSIA fondly recall how Liñán would continue answering questions at the blackboard long after the official end of a lecture, and when the next professor politely asked him to leave the classroom, the discussion would simply continue in the hallway. It seemed that no question could ever go unresolved.

As a mentor, Liñán inspired in his students and collaborators a tireless enthusiasm and boundless curiosity. He possessed an innate ability to recognize talent and a natural gift for motivating and fostering dedication to scientific research. Beyond his direct PhD students, many others consider themselves his former students, either because they took their first steps in research under his guidance or, like one of us (ALS), because his explicit support enabled them to pursue graduate studies at some of the world's leading universities.

In addition to educating several generations of Spanish engineers, many colleagues and co-authors benefited greatly from working with him. Indeed, we have learned more from him than from anyone else. In many ways, he was the ideal collaborator: with infinite patience, he would explain a problem repeatedly, often rederiving results from scratch, completely oblivious to time, until it was absolutely clear that we fully understood. His friendly and earnest explanations were invaluable to all who worked with him.

From a personal standpoint, Amable Liñan truly lived up to his name ("Amable" means gentle in Spanish). He was extraordinarily humble. When asked to reflect on his lifetime scientific achievements, he would always downplay his own role, attributing all the credit to his mentors (especially Gregorio Millán and the other members of the combustion group at INTA) and to his students and collaborators. His demeanor was always cordial, considerate, and attentive. In scientific exchanges with students and collaborators, he had the rare gift of never making anyone feel inadequate, no matter how trivial the question. With remarkable simplicity, he would correct errors in the work presented to him and, in their place, construct a problem formulated with rigor and elegance, where physics and mathematics always went hand in hand.

To speak of Liñán without mentioning his wife, Rosita, would be to leave the portrait incomplete. Throughout most of his academic career, Rosita stood by him as his tireless partner, managing all the family logistics for which Liñán was less suited. Undoubtedly, it is thanks to her that he was

able to devote his energy to understanding combustion and helping the rest of us understand it as well.

Amable Liñán was a scientific giant whose impact extended far beyond his research, through his masterful teaching and his gracious, gentle manners. He will remain a source of inspiration to all who had the privilege of his friendship. He will be deeply missed.

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