



Professor ENRIC RAS I OLIVA (1915–2007)*

Enric Ras i Oliva, a recognized authority in engineering and a significant academic figure, passed away at the age 92 on 19 April 2007 in Benicarló (Castelló, Spain). Throughout his professional life he was deeply involved in engineering, not only as manager and technical director of AEG Ibérica de Electricidad S.A, but also in institutional engineering, through the Industrial Engineering Association of Catalonia, and in academia, holding positions at the Technical University of Catalonia (UPC) and several other academic institutions. He was a member of the Institute for Catalan Studies (IEC) (the National Academy of Catalonia) and of the Royal Academy of Sciences and Arts of Barcelona. The wide scope of his interests and his influence in the field of engineering were recognized in numerous awards and through his many different collaborations with the Autonomous Government of Catalonia.

The following biography is mainly structured along the three aspects of Enric Ras' activities: professional engineering, institutional engineering, and his university and academic career.

A young engineer at the crossroads of the Spanish Civil War

Enric Ras was born in Tarragona in 1915, where he graduated from secondary school at the age of 14 with the highest qualification; at the time, he was one of the youngest secondary

school graduates in Spain. Continuing his studies in Barcelona, he received a degree in Industrial Engineering at 21 in 1936, two years younger than the average graduate. Industrial Engineering—with its emphasis on mechanical, electrical, and product engineering—was the only higher-level degree in engineering that could be obtained in Catalonia at the time.

Unfortunately, the Spanish Civil War started just after Ras' graduation, with serious consequences for the country and for his professional development. At the end of the war, he completed the studies he had initiated in parallel with those of engineering and obtained a degree in Mathematics. After the doctoral degree (equivalent to a Ph.D.) in engineering was introduced in Spain, the General Board of Qualification awarded him the degree of Doctor of Industrial Engineering, in 1960.

During the Spanish Civil War, Ras worked at SAF3—the name adopted by the factory belonging to the Construcciones Aeronáuticas S.A. of Getafe (Madrid) following its move to Reus (Tarragona)—in aeronautical supplies, where he was in charge of heat treatments in the department of metallography. In fact, he had qualified as a specialist in metallography, achieving the highest grades, in a previous postgraduate course. After the war, from 1940 until 1942, he headed the technical office in the Blanes (Girona) factory of the Sociedad Anónima de Fibras Artificiales.

A world-renowned engineer

In 1942, Ras joined the firm AEG Ibérica de Electricidad S.A., as head of its technical office. He was later appointed manager

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and then national technical director of the firm, a post he held for the rest of his professional life, until 1977. During that time, he was in charge of the AEG Industrial S.A. in Terrassa (Barcelona) factory, which produced transformers and switches. The great responsibilities associated with his post of technical director of AEG prevented him from accepting a high-level position either at the university or in the many professional and academic institutions he belonged to.

Nonetheless, he was very active in the Industrial Engineers' Association of Barcelona (later of Catalonia), serving as its secretary (1954–1960) and as a member of its Executive Board as well as its second (1986) and first (1989) vice president. In addition, he was one of the founders of the Association's technical review "Novatecnia," in 1970, and of its Engineers' Improvement Center. The latter was devoted to the continuous training of engineers, the need for which was recognized in Spain in the 1960s. Ras was deeply concerned with the engineer's responsibility to society and to the environment, as well as with the need for training, and he publicized these dual concerns in numerous speeches, articles, and conference papers [1–15]. This led to his organizational involvement in many conferences, symposiums, workshops, and technical meetings concerning the training and professional activities of engineers. Among them, he was particularly active in the organization of and participated in:

- Réunion Générale de la Commission Électrotechnique Internationale. Madrid, 1959
- I Semana de la Formación. Barcelona, 1968
- Conférence Internationale sur les tendances de l'enseigement et de la formation des ingenieurs (National Association of Industrial Engineers representative). UNESCO, 1968.
- II Semana de la Formación. Barcelona, 1968
- I Congreso de la Formación. Barcelona, 1970
- IV International Congress of Engineers. (FEANI: Fédération Européenne d'Associations Nationales d'Ingenieurs). Barcelona, 1974
- World Electrotechnical Congress. Moscow, 1977
- III Congrès Universitari Català. Barcelona, 1979
- Conférence Internationale des Grans Reseaux Électriques, of which he was a permanent member from 1951 until 1985. On several occasions, he represented the Technical University of Barcelona or the Industrial Engineers' Association.

His commitment to professional engineering earned him great respect in the professional community, reflected in his participation in many professional boards and committees. He was therefore an obvious choice as adviser of the Autonomous Government of Catalonia for engineering-related subjects:

- Member of the Spanish Electrical Engineering Association since 1956, and active on its national board since 1979
- Member of the Association of the Museum of Science and Technology (1979) as representative of the Industrial Engineers' Association of Catalonia
- Member of the Engineers Institute of Catalonia since its creation, in 1981, until 1995

- Member of the Scientific and Technological Council, since its foundation in 1982, by appointment of the Presidency of the Autonomous Government of Catalonia
- Member of the Advisory Committee of the General Laboratory of Testing and Research of the Autonomous Government of Catalonia since 1985
- Member of the managing board and, later, founder of the Catalan Technological Institute in 1986
- Member of the managing board and, later, founder of the Catalan Inspection and Technical Control Institute in 1986

His good command of English, French, and German, besides his two native languages, Catalan and Spanish, was an invaluable asset in his professional life not only as an engineer but also in his active participation in international meetings. He also wrote several multilingual dictionaries related to electrical engineering [see Books: 6–9].

A relevant academic personality

As the son of a secondary school teacher in Mathematics, Enric Ras inherited his passion for teaching and his great skill as a teacher. Quite soon, in 1944, he was appointed assistant lecturer on Topography and Geodesy in the Higher School of Industrial Engineering of Barcelona; later, in 1958, he held the Chair of Electricity in the same school, a position he maintained for 41 years until his compulsory retirement in 1985 at the age of 70. From 1987 until 1992, he was Emeritus Professor of the Technical University of Catalonia (UPC). In 1976, on the occasion of the school's 125th anniversary, he was commissioned to write the commemorative essay *Engineering antecedents in Catalonia. Reflections on Spanish scientific and technical backwardness* (in Catalan) [8].

Enric Ras excelled in his academic career, being one of the last of the "old school's" great professors. In Spain, professors that were renowned, active engineers, mostly at the level of manager or technical director, came from the country's elite industrial firms. Professionals like Ras were highly regarded in academia because they were able to teach engineering with great authority based on first-hand knowledge and experience. Two other, no less relevant factors contributed to Ras' teaching success. First, he was widely recognized for his background as a mathematician, which was evident in the rigorous structure of his lectures, and, second, he maintained good personal rapport with his students.

Enric Ras' proven capacity in his field and his personal qualifications as an outgoing organizer also increased his academic recognition. In 1972, he was elected Head of the Electrical Engineering Department. In 1977, he was appointed as one of the Vice-Presidents of the Technical University of Catalonia, representing it at the Interuniversity Council of Catalonia in 1979, an engagement he kept until his retirement. Shortly after his retirement, the Autonomous Government of Catalonia named him a member of the Board of Trustees the Technical University of Catalonia (UPC), where he remained until he was appointed Emeritus Professor in 1987.

As the holder of a university Chair, Ras wrote, in Spanish, several textbooks on electrical engineering [see Books: 1–5]. The first two, *Circuit theory: fundamentals*, published in 1968, and *Transformers: of power, of measurement, of protection*, were recognized with the “Award for the most relevant technical book” of the Spanish Association of Industrial Engineers, section of Bilbao, in 1971. His last textbook was the revised and enlarged edition of *Theory of electrical lines, vol. I*, in 1986. The first edition of vols. I and II of this book received the 1976 “Award for the most relevant technical book” of the Spanish Association of Industrial Engineers. Besides the publication of his own books, he translated several technical works, including volume I of *Bases científicas de la electrotécnica* (1956, Labor, Barcelona) and Gunter Oberdorfer’s *Tratado de electrotécnica*, one of the most famous treatises on electrical engineering and required reading for generations of industrial engineers.

In 1960, Ras was elected full member of the Royal Academy of Sciences and Arts of Barcelona, of which he was Vice President (1977–1980). He ran the section of Physics, Chemistry and Electrical Engineering during two terms (1969–1977 and 1984–1987) and published several academic reports in the Academy’s *Proceedings* [6,10,15,17,19,20,23]. The Academy also commissioned him to write a historical work on *Francisco Salvá y Campillo*—a pioneer of the electrical telegraph (1796), as recognized by Guglielmo Marconi years later—to commemorate the 200th anniversary of Campillo’s birth. The work was published in 1965 in the *Revista San Jorge de la Diputación Provincial de Barcelona* (Saint George Journal of the Barcelona Provincial Council) [18].

Following his appointment as an associate member of the Institute for Catalan Studies (the National Academy of Catalonia), in 1978, he was elected full member in 1981. He served as a member of the Regulatory Board in the cooperation between the Autonomous Government of Catalonia and the Institute for Catalan Studies from 1989 until the end of the agreement in 1992.

During the period when Ras taught at the Higher School of Industrial Engineering of Barcelona, two significant changes took place in that institution. First, the school was integrated within the Technical University of Catalonia. Until then, it had been dependent, on the corresponding ministry, but at the end of the 1960s it and the other engineering schools were made part of the Spanish university system. Second, research efforts were blossoming at the school and within academic engineering institutions in general. While research had been an inherent part of universities, this was not the case at the schools of engineering. Engineering research, mainly applied technical research, had previously been carried out by engineers in industry, with the results submitted to the patent office and not to scientific journals. This began to change in the 1960s, as industry’s demand for basic technical research increased; this type of research was best done at the engineering schools and university. However, a doctorate in engineering, in recognition of successful academic research, was not introduced into the field of engineering in Spain until 1960, 24 years after Enric Ras’ graduation as an engineer.

Enric Ras, even though not directly involved in research,

studied and analyzed its development, devoting several articles and conference papers to its increasing importance. At first glance, his bibliography looks unusual for a university professor because of the lack of academic, i.e., research, publications, but it must be considered from the Spanish perspective concerning engineering school practice at the time. Enric Ras was, as an engineer of his era, an outstanding writer and he wrote extensively on engineering and the training of engineers, but, unusual at the time, he also authored original research articles, most of which were published by the Royal Academy of Sciences and Arts of Barcelona [16,17,19,20,23].

Enric Ras received numerous and significant awards for his professional, institutional and academic activities, including:

- Cross of Sant Jordi Award of the Autonomous Government of Catalonia (1992)
- Great Cross of the Order of Alfonso X the Wise, awarded by His Majesty the King of Spain (1985)
- Narcís Monturiol Medal Award of the Autonomous Government of Catalonia for services to Catalonia in the field of scientific and technological progress (1986)
- Gold Medal Award of the Spanish Electrical Engineering Association (1975)
- Honorary President of the Industrial Engineers Association of Catalonia (1992)
- Emeritus Professor of the Technical University of Catalonia (1987–1992)

Epilogue

Enric Ras was an exemplary teacher and one of the great minds in engineering, yet he did not ignore his social environment. The emphasis during his childhood on social responsibility and the predominance of culture and justice had far-reaching influence throughout his life. His writings on the environmental responsibility of the engineer made him a pioneer in his inclusion of ecology and sustainability in the field of industrial engineering.

Publications by Enric Ras

The following bibliography contains the titles of scientific articles, books, and a selection of other publications written by Enric Ras.

Publications on the training and profession of the engineer

1. El Ingeniero y su formación (1959) Barcelona (academic year 1959–1960, opening lecture at the Higher School of Industrial Engineering of Barcelona)
2. Communication at the Industrial Engineers Association concerning the Conférence internationale sur les tendances de l’enseignement et la formation des ingenieurs UNESCO (1969) Bulletin of the Catalan College of Industrial Engineers, Barcelona
3. Lo básico en la formación. Buscando la senda en la era tecnológica (1970) I Congreso de la Formación, Barcelona

4. Ambiente y formación (1970) Novatecnia, Barcelona (Associated with the I Congreso de la Formación)
5. Motivacions actuals i futures de la tecnologia. Responsabilitat de l'enginyer (1973) Novatecnia, Barcelona (Workshop on the Foundations of Sciences organized by the Catalan Society of Physics, Chemistry and Mathematics)
6. Reflexiones: salud ecológica, formación, Universidad (1973) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd era (academic year 1973–1974 opening lecture)
7. Consejo Mundial de Universidades. Federaciones de asociaciones Profesionales. Responsabilidad del Ingeniero (1974) VI International Congress of Engineers (FEANI: Fédération Européenne d'Associations Nationales d'Ingenieurs), Barcelona
8. Antecedents de l'enginyeria a Catalunya. Reflexions sobre l'endarreriment científico-tècnic espanyol (1976) Published by the Higher School of Industrial Engineering of Barcelona on its 125th anniversary, Barcelona
9. Recerca i vinculació de la Universitat al seu entorn (1978) 3rd University Congress of Catalonia, Barcelona
10. Progrés, societat, home. Reflexions sobre les universitats tècniques (1979) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd epoch, Barcelona
11. Ciència i tècnica al servei de Catalunya (1981) Technical workshop organized by the Industry and Energy Department of the Autonomous Government of Catalonia, Barcelona
12. Innovació tecnològica a la petita i mitjana indústria. Línies d'actuació (1982) Industry and Energy Department of the Autonomous Government of Catalonia, Barcelona
13. Catalunya i la tecnologia com a fet cultural: adequació de l'ensenyament tecnològic universitari (1983) Institute for Catalan Studies, Barcelona (academic year 1982–1983, opening lecture)
14. Cultura de la crisi. Visions de l'enginyeria. Rejuveniment de la societat (1985) Barcelona (address at the public gathering honoring his retirement)
15. Perspectives de l'enginyeria. La segona Universitat (1987) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd era, Barcelona
16. Teoría de circuitos, fundamentos (1968) Boixareu Editores, Barcelona, 348 pp
17. Transformadores de potencia, de medida, de protección (1969) Boixareu Editores, Barcelona, 273 pp
18. Análisis de Fourier y cálculo operacional aplicados a la electrotécnica (1979) Boixareu Editores, Barcelona, 340 pp
19. Redes eléctricas y multipolos (1980) Boixareu Editores, Barcelona, 370 pp
20. Teoría de líneas eléctricas vols. I–II (1973–1975) Universitat Politècnica de Barcelona, 299 pp. and 419 pp. (New revised and enlarged edition of Vol. I in 1986)
21. Diccionari conceptual de l'electrotècnia: alemany-català-castellà (1990) Industrial Engineers Association and Boixareu Editores, Barcelona, 179 pp
22. Diccionari conceptual de l'electrotècnia: català-castellà-alemany (1992) Industrial Engineers Association and Boixareu Editores, Barcelona, 187 pp
23. Diccionario conceptual de la electrotécnica: español-catalán-alemán (1992) Industrial Engineers Association and Boixareu Editores, Barcelona, 202 pp
24. Diccionari multilingüe de l'electrotècnia: català-espanyol-francès-anglès-alemany (1996) Industrial Engineers Association and Boixareu Editores, Barcelona, 262 pp

A selection of other publications

25. Las matemáticas especiales en la técnica moderna (1960) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd era, Barcelona (academic year 1960–1961, opening lecture)
26. Estado actual y posibilidades de las transferencias de la energía eléctrica a base de corriente continua (1962) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd era, Barcelona
27. Francisco Salvá y Campillo (1965) Revista San Jorge de la Diputación Provincial de Barcelona, Barcelona (Historical work commissioned by the Royal Academy of Sciences and Arts of Barcelona on the 200th anniversary of the birth of Campillo)
28. Últimos progresos y perspectivas en el uso de la corriente continua (1968) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd era, Barcelona
29. Posibilidades y límites actuales de las transferencias por corriente continua (1971) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd era, Barcelona
30. Directrius per a un enllaç Mallorca-Eivissa de transmissió d'energia mitjançant corrent continu (1982) Institute for Catalan Studies, Barcelona
31. Qui va ser en... Joan Ras i Claravalls (1983) L'Escaire, Barcelona (review of mathematical teaching)
32. Perspectives de los transportes de energía eléctrica (1985) Proceedings of the Royal Academy of Sciences and Arts of Barcelona, 3rd era, Barcelona

Books

16. Teoría de circuitos, fundamentos (1968) Boixareu Editores, Barcelona, 348 pp
17. Transformadores de potencia, de medida, de protección (1969) Boixareu Editores, Barcelona, 273 pp