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OBITUARY

PLACIDO CICALA (1910–1996)

Prof. Placido Cicala, a frequent contributor to this Journal in its first years, passed away on 16 June 1996. As a tribute to His memory, "Meccanica" publishes a synthesis of the two speeches presented at a commemorative ceremony held at the Accademia delle Scienze di Torino on the first anniversary of His death.

The almost simultaneous departures of Carlo Ferrari and Placido Cicala close the glorious time in which the direct disciples of Modesto Panetti brought the Turin School of Applied Mechanics up to the world highest levels. Today we commemorate one of the most brilliant members of that group, Placido Cicala, who under a shy and unpretentious demeanour, concealed a truly ingenious and creative mind which with surprising versatility lead him, well beyond the boundaries of his original subject, into the field of structural mechanics.

He was born in 1910, and in 1933 already held two University Degrees, in Mechanical and Aeronautical Engineering, both obtained "summa cum laude". Research Assistant of Panetti since 1934 and Lecturer since 1935, Cicala obtained the "Libera Docenza" in 1936 and a Full Professorship of Aeronautical Constructions at the Politecnico di Torino in 1942. After four years in Argentina, He returned to His Chair in Turin in 1952, and moved in 1957 to a Professorship of "Scienza delle Costruzioni", which He held until retirement. He was also a Visiting Professor at Purdue University, and presented lectures at Stanford, Yale and the University of Illinois.

Cicala has been a Member of the Accademia delle Scienze of Turin since 1952 and of the Accademia dei Lincei since 1972. His scientific publications amount to about 200. The awards and honours that he obtained along His career are too numerous to be listed.

To illustrate Cicala's approach to teaching, the Preface to the First Edition of His textbook of "Scienza delle Costruzioni", can be quoted:

"I have renounced to treat procedures not very general, albeit appealing for their elegance or the simplifications they may allow, and have instead given emphasis to those universal tools that the student, later engineer, must be able to handle perfectly and that must provide him the key to understand others' researches and to solve novel problems"

Indeed, like His great predecessors Guidi and Colonnetti, Cicala had posed Himself the key question of all Professors of "Scienza delle Costruzioni": should the course start with the fundamentals of the Theory of Elasticity, or from examples of beam structures, dealt with by means of simplified methods to be proved later? The "theoretician" Cicala had no doubts: he chose the second solution, so that the students could immediately feel the applied objectives of the subject, understand the basic concepts of statics and dynamics, and avoid the abstract preliminary study of infinitesimal elements.

Cicala found "an essential tool" of this methodology in the Virtual Work equation. In His textbooks, numerous examples illustrate the use of this principle. Just to quote one, let us find the vertical displacement f in the centre section of the m–n span of a continuous beam, whose moment diagram M_b has already been found (system b). Let us create a "fictitious" equilibrated system a, in which the same span m–n is loaded by a unit force $F = 1$ in the centre section and two forces 1/2 F in the end sections. Applying the Virtual Work equation, the "external" work reduces to $1^* f$, but also the "internal" work $\int M_a M_b / EI \, dz$ is very simple to calculate, because the "fictitious" bending moment M_a is everywhere nil except in the relevant span m–n.

Cicala tackled in an original way another fundamental problem of "Scienza delle Costruzioni", namely the Saint Venant's beam problem, for which He proposed an indirect asymptotic solution, in which the unknown functions are represented as power series of a "small" parameter (e.g. the thickness of the section). Again, a very general approach with a very wide range of applications, without simplifications to be justified example by example. A way to furnish students and engineers tools "*to understand others' researches and to solve novel problems*".

Many more themes of Cicala's interests within the two fields of His teaching, "Scienza delle Costruzioni" and Aeronautical Constructions, could be cited. But they would overlap with the themes of His research work, that is the subject matter of next speech, by our common friend Antona.

Franco Levi

(*Translated and abridged by G. Augusti*)

Great were Placido Cicala's qualities that made Him peculiar as teacher, colleague, friend, and – in a more personal sphere – son, husband, father. But this speech is not devoted to these qualities, important as they may be, but to His scientific achievements and to what they may mean for future development of our Science. Indeed, in a time in which automatic calculus is privileged, a myopic viewpoint might underestimate Cicala's contributions, which on the contrary can enhance the capabilities of automatic calculus and make clear the physical-mathematical bases of several problems.

Cicala was well aware of this possible misunderstanding: he often remarked that he followed a troublesome path, within range both of the mathematicians' fire, who could find his approach not rigorous enough, and of the engineers' fire, who often objected to it being too little engineering-minded. A typical example of such criticisms is a contained in a classical treatise on shell theory, in which the Author praises the "*keen method*" of Cicala's classification of solutions and recognizes that "*the systematic approximation approach leads to impressive final results*", but then defines an "*inconvenient*" the use of vectors rather than tensors to study the geometry of surfaces, deformations and stresses, thus missing the main point of Cicala's view point: to master mathematical tools but use them in function of the difficulties to tackle, with always the aim of making the physical phenomena as evident as possible.

In a rough classification, the researches of Placido Cicala can subdivided into six main subjects: aerodynamics of wing profiles, in particular in non-stationary motion; calculus of variations; shell theory, with particular reference to reinforced shells; influence of imperfections on buckling loads and "jump instabilities"; asymptotic approaches; non-homogeneous and elasto-plastic materials. In all these subjects, he made original, and often pioneering, contributions.

His early (1935–37) works on aerodynamics of wings were quoted among the main Italian contributions to Aerodynamics and Aeronautical Constructions in a well-known Volume entitled "A century of Italian Scientific Progress 1839–1939". The integro-differential "Cicala's equation" on the non-stationarty flow around the wing profile has been seen as a general case of Prandtl's equation and has been used by many Authors up to the 50's.

Cicala presented a novel approach to Variational Calculus, that allows engineers to search for extremal conditions without recurring to methods of functional analysis, in a cycle of lectures at Purdue University:[1] The convenience of formulating in a consistent way the body of knowledge and methods for the solution of variational calculus and optimal control problems without requiring the knowledge of higher mathematics, is – in my view – also the idea at the basis of Pontryagin's principle, but Cicala' formulation appears more efficient: in fact, on the one hand it makes the reader to understand fully the meaning and the implications of the mathematical conditions that must be satisfied, on the other hand because a transformation that is necessary in Pontryagin's formulation is sometimes (although seldom) impossible. An extension of Cicala's work was cited by Kopp in his 1961 book on "Optimization Techniques" as the basis for the minimum principle.

In the early 40's, Cicala did really pioneering work on the influence of small, unavoidable imperfections on the buckling load of thin shells and similar structures. Unfortunately, also due to the difficulties of exchanges in that war period, his discoveries had not the international diffusion and recognition that they deserved.

Space does not allow further details. But let me close by quoting from one of those letter that Cicala's friends well knew, because he appeared to trust more his thoughts when in writing (he used to say "before a sheet of paper I feel more accurate"). Indeed, in this specific letter he spoke of his current research efforts on the analysis of shells, and concluded "However things will go, I do hope that my labours will not be lost": apparently, he had full conscience that the product of his talent were (and are) able to open new avenues.

Ettore Antona

(*Translated and abridged by G. Augusti*)

[1] The book "An Engineering Approach to the Calculus of Variations", based on these lectures, was published in 1957 and reprinted in 1964. Cicala completed a new edition shortly before His death. This second edition has been published by the Department of Structural Engineering of the Politecnico di Torino: some copies are available for interested readers of "Meccanica" from that Department Corso Duca degli Abruzzi 24; 10124, Torino, Italy.