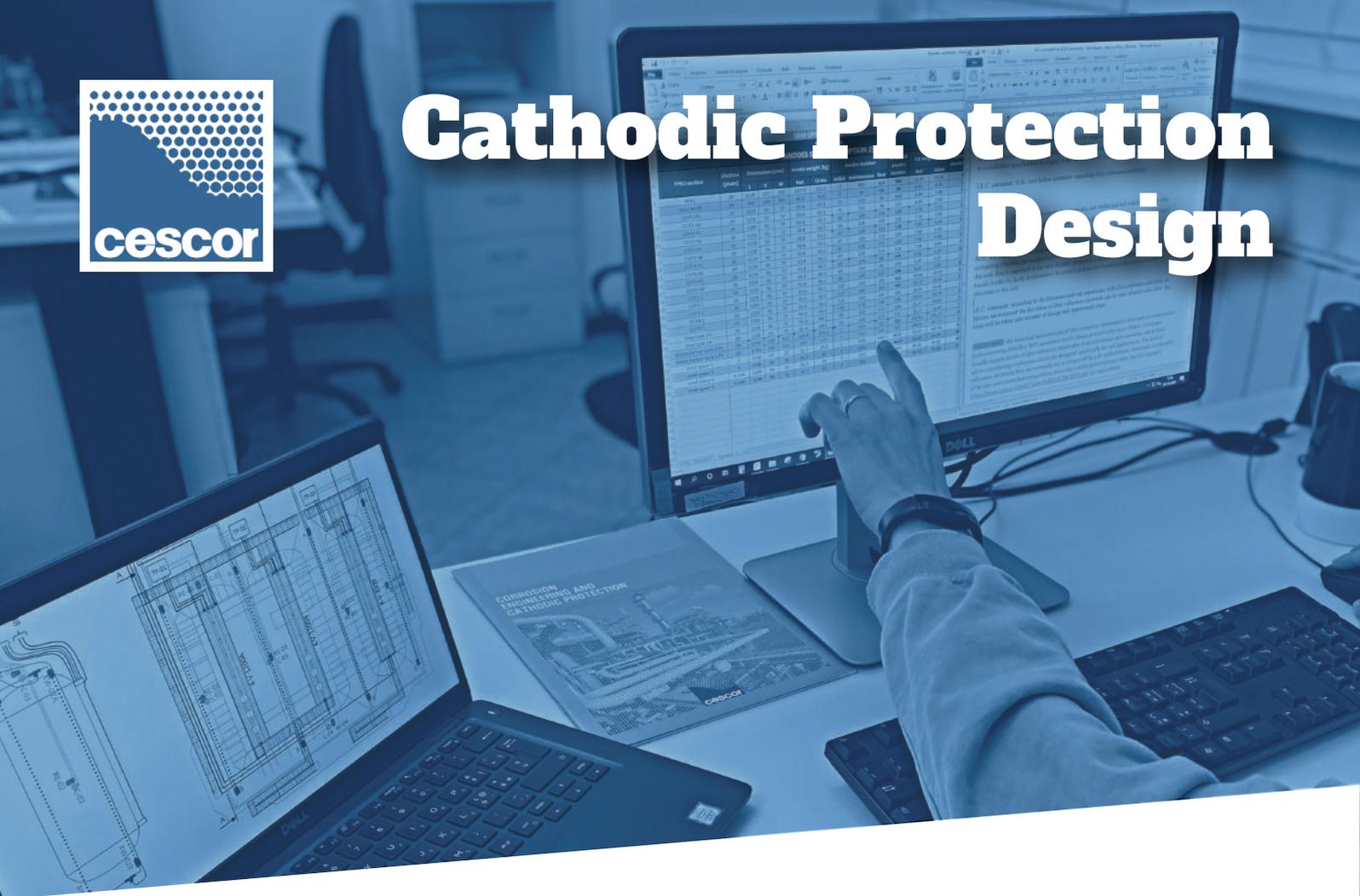




Cathodic Protection Design



☐☐☐☐ Cathodic Protection and its Design

Cathodic Protection is an electrochemical technique to prevent corrosion of metals.

It can be virtually applied to any structure in contact with a conductive medium, like soil, seawater, or concrete (Fig.1).

Depending on several factors, such as the type of environment, cathodic protection can be applied in two different ways:

- by Galvanic Anodes (GACP) or
- by Impressed Current (ICCP).

By preventing external corrosion, cathodic protection contributes to guarantee the integrity of important assets like pipelines, offshore platforms and civil infrastructures.

A CORRECT DESIGN IS THE KEY FACTOR FOR THE CORRECT PERFORMANCE OF ANY CATHODIC PROTECTION SYSTEM.

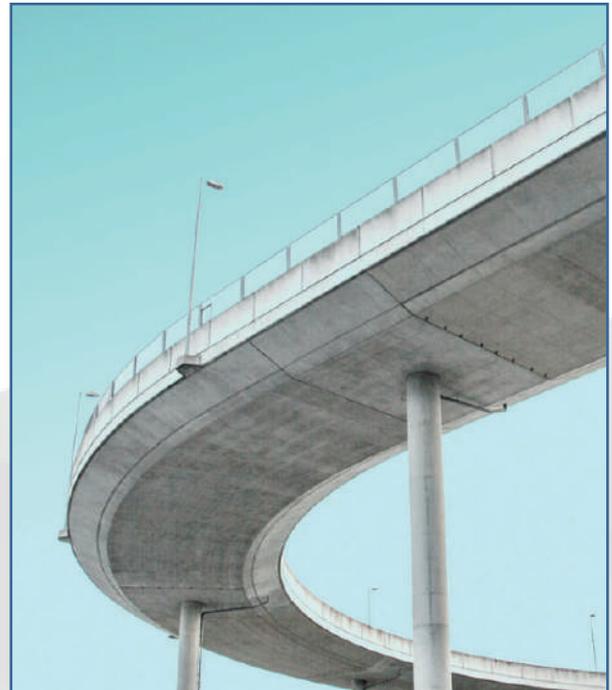


Fig. 1 – Reinforced concrete infrastructure as one of the field of application of cathodic protection

☐☐☐☐ Cathodic Protection applications

Cathodic protection is applied by forcing a small continuous current to flow from the environment to the structure to be protected (cathode). This current interferes with the ongoing corrosion process producing a decrease in the potential of the metal which results in the reduction up to zero of its corrosion rate.

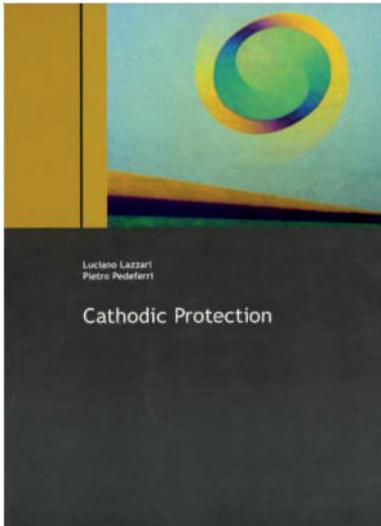


Fig.2 – Book cover for Lazzari-Pedferri, "Cathodic Protection"

Based on the method used to circulate the current, the two types of cathodic protection are defined:

- **GALVANIC ANODES:** cathodic protection is achieved through galvanic coupling with a less noble metal;
- **IMPRESSED CURRENT:** cathodic protection is achieved by using a DC feeder, where the positive pole is connected to an insoluble anode, and the negative one is connected to the structure.

CESCOR extensive and specific competence for the design in multiple sectors is also witnessed by several papers presented at main Corrosion Conferences in the world.

Our strong competence and scientific background are also represented by the book on Cathodic Protection (Fig. 2), from Luciano Lazzari, President of CESCOR, and Professor Pietro Pedefferri, one of the company founders.

☐☐☐☐ Our expertise at your service

In the last thirty years, we have matured a broad technical experience dealing with cathodic protection design, and we can provide engineering skills in all types of applications and structures, being these new ones – design case, as well as in service – operation case, for which we do provide retrofit solutions.

For each project, design is accomplished by always taking into account several aspects:

- Details of the structure to be protected
- Status of the structure: new or in service
- Local exposure and environmental conditions
- Medium: soil; seawater; fresh water; concrete and others
- Design life
- Material requirements
- Monitoring and inspections
- Safety and environmental issues
- Cost effectiveness

The design provided is always in accordance with latest International Standards, National Regulations and Company Standards as for our personnel, certified in accordance with International Standard ISO EN 15257.

Finite Element Modeling (FEM) or Boundary Element Modeling (BEM) are recurrently used as design tools to anticipate and optimize distribution of protection conditions on the structure (Fig.3).

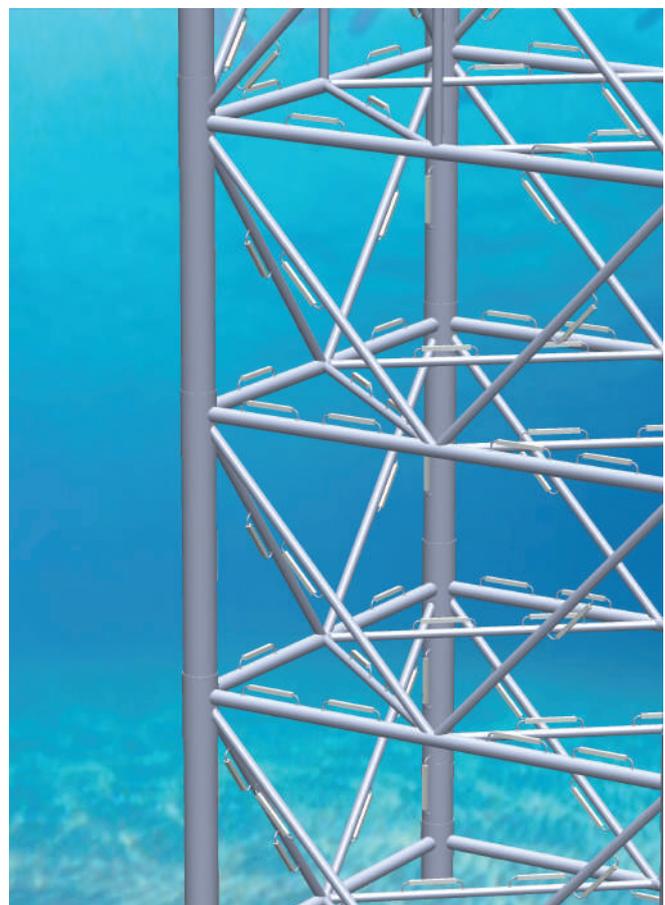


Fig.3 – Example of steel jacket protected by galvanic anodes. Positioning of anodes is optimized by FEM.

Application Sectors

CESCOR gained a deep experience in all types of industrial application of cathodic protection (Fig.4):



Fig.4 – Infographic example of some of those sectors we operate in.

CESCOR CONSTANTLY LOOKS FORWARD TO CHALLENGING AND INNOVATIVE PROJECTS

Integrated services

CESCOR provides its Clients the following services integrated to the design of cathodic protection systems:

- Soil resistivity and cathodic protection preliminary surveys
- Material procurement and quality control
- Installation supervision
- Commissioning
- Periodical inspection services, onshore and offshore
- Consultancy

Sustainability Commitment

We proudly deem sustainability and take into account safety and environmental matters as stated in the company core values (Fig.5).

Henceforth, during the design phase of cathodic protection systems, we specifically evaluate safety and environmental aspects.

Those accounted in the design of cathodic protection systems include:

- Corrosion risk assessment
- Metal ion release in galvanic anode systems
- Chlorine evolution in impressed current systems and impact on marine environments
- Hydrogen production in confined environments and impact on safety
- Risk of sparking caused by falling anodes
- Impact of ground beds on water table contamination
- Selection of green materials
- Material requirements for de-commissioning



Fig 5 - Sustainability is one of our core values.

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