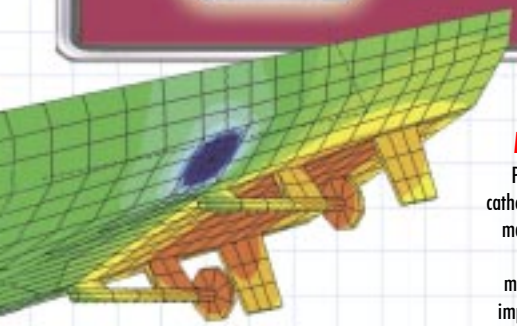
Corrosion and CP Software



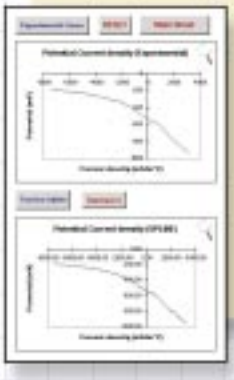
Marine Applications

Predicting the performance of cathodic protection systems in the marine environment is a major application area of computer modelling. Both sacrificial and impressed (ICCP) systems on oil and gas structures, ships and boats can be modelled.

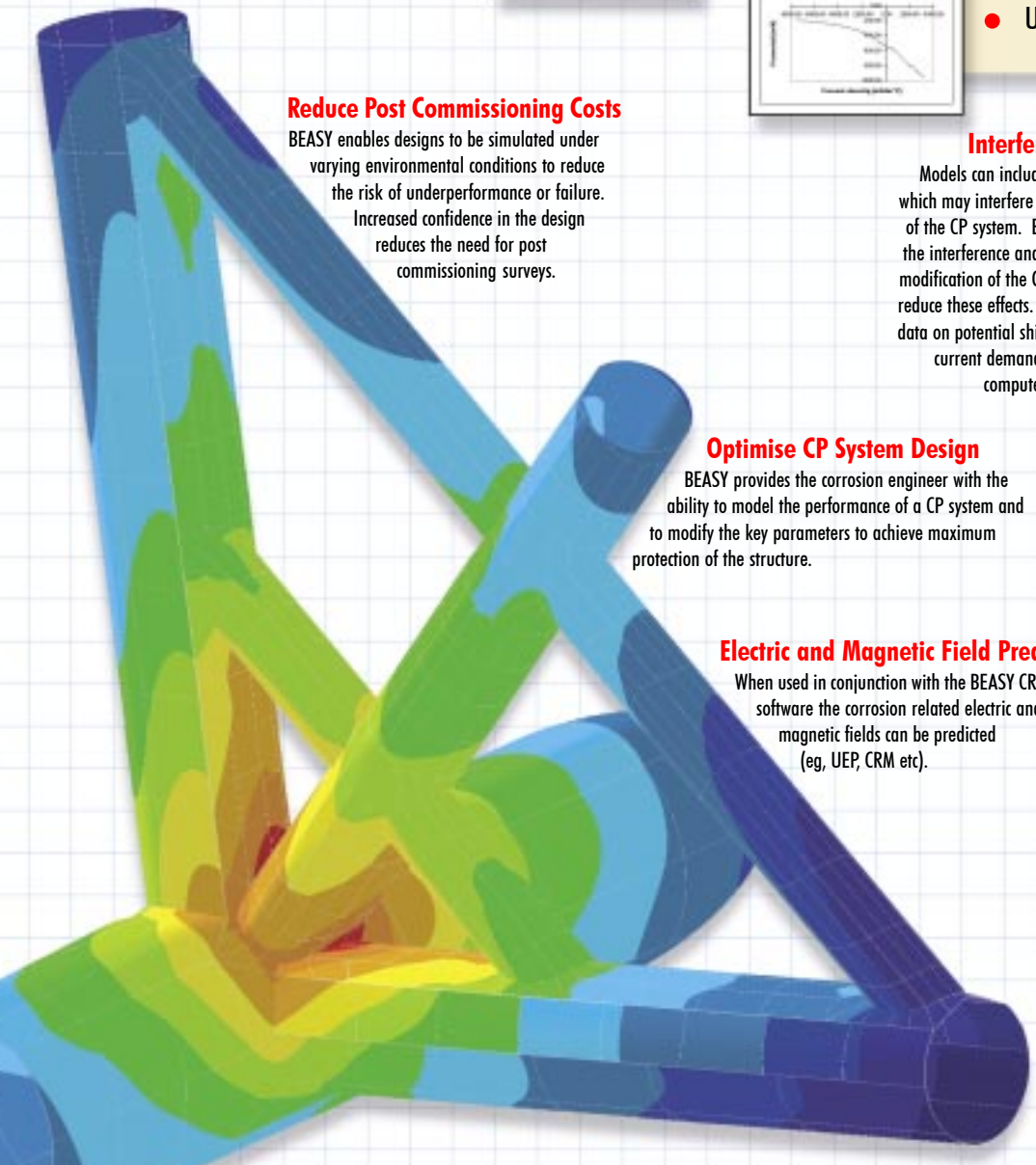
Simulate Galvanic Corrosion

BEASY can be used by the designer to simulate the electric fields and electrochemical reactions (polarisation) present in corrosion applications. Potential levels and currents can be predicted on metallic structures in the surrounding electrolyte.

BEASY predicts how effective proposed corrosion control strategies are at protecting structures and how they will perform over a structure's life cycle. Also, how they will interfere with nearby systems



- Simulating galvanic corrosion
- Optimise CP system design
- Reduce post commissioning costs
- Reduce interference
- Electric and magnetic field prediction
- Marine application
- Underground infrastructure applications

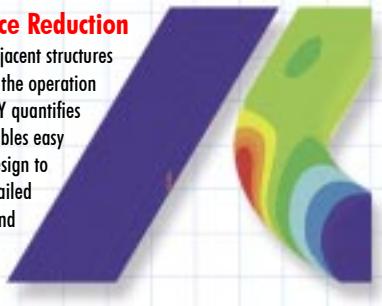


Reduce Post Commissioning Costs

BEASY enables designs to be simulated under varying environmental conditions to reduce the risk of underperformance or failure. Increased confidence in the design reduces the need for post commissioning surveys.

Interference Reduction

Models can include adjacent structures which may interfere with the operation of the CP system. BEASY quantifies the interference and enables easy modification of the CP design to reduce these effects. Detailed data on potential shifts and current demand are computed.



Optimise CP System Design

BEASY provides the corrosion engineer with the ability to model the performance of a CP system and to modify the key parameters to achieve maximum protection of the structure.

Electric and Magnetic Field Prediction

When used in conjunction with the BEASY CRM software the corrosion related electric and magnetic fields can be predicted (eg, UEP, CRM etc).

Underground Infrastructure Applications

It is difficult to imagine how many different kinds of electrical impulses surge through today's underground environment. Power lines, transit rail lines, communication cables and industrial plant foundations are just a few of the contributors to this buried infrastructural nervous system.

BEASY provides the tools to understand this complex system and predict how pipeline and storage tank cathodic protection systems will perform.

Computer Requirements:
Windows 95, 98, NT, 2000 or Unix Workstation.

BEASY is compatible with existing modelling tools such as PATRAN and IDEAS.

Windows users can also use BEASY's own modelling tools.

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Application Areas

- Simulation of galvanic corrosion
- Design of cathodic protection systems
- Simulation of electrodeposition and other similar processes
- Electrostatic analysis
- Prediction of current demand
- Marine corrosion control
- Pipeline design and maintenance

Benefits

Improved and More Reliable Design

- Optimisation by simulation
- Optimisation of anode location
- Life Prediction
- Prediction of current densities and potentials on structure surfaces and in electrolyte
- Training simulator for CP design engineers
- Prediction of corrosion rates
- Prediction of current demand and how it changes with time
- Evaluation of new CP designs
- Investigate new anode types and shapes
- Prediction of anode consumption rate, life expectancy, diameter reduction
- Optimise anode and reference electrode location
- Optimisation of CP retrofit programs

Interference Prediction, Control & Reduction

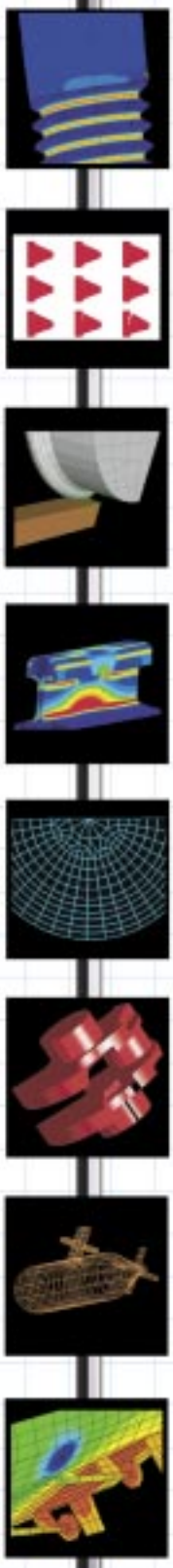
- Electric field prediction
- Prediction of stray current and interaction of CP systems
- Independent galvanic systems can be defined
- Interaction between the systems can be predicted

Accurate Prediction

- Evaluation and interpretation of inspection data
- Simulates changes in environmental conditions
- Detailed local models of critical areas of a structure (eg surface nodes, pile guides etc)
- Global models of large and complex structures
- Simulate build up of calcareous scale

Comprehensive Features

- Impressed and Sacrificial anodes system
- Simple modelling of large ocean regions
- Detailed representation of non linear polarisation
- Time dependent and steady state predictions
- Multiple region analysis to represent electrolytes of differing properties
- Representation of static and time dependent non linear polarisation
- Flexible structure for polarisation data and simulating various environmental condition parameters
- Simple representation of field boundaries (eg infinite boundaries)
- Independent (floating) electrodes can be simulated



Element Library

- Complete range of elements including both discontinuous and continuous elements
- Hierarchical element types allow model refinement without change of mesh
- For three dimensional problems: quadrilaterals and triangles
- For two dimensional and axisymmetric problems: isoparametric lines
- All elements have high order shape functions for accurate model representation

Analysis Features

- Comprehensive checking of data and of computer resources required ensures that no analysis runs are wasted
- Local error guides to give clear indication of solution accuracy
- Evaluation of total current balance
- Efficient and economical solution at as many user-specified "internal points" as required
- Step-by-step analysis option allows re-analysis to be carried out after minor changes without recalculation of matrices

Zoning or Substructuring

A model can be split into any number of zones or substructures to represent different components or electrolytes and to improve the run times and use of computer resources.
Interface conditions between zones include:-

- Added current
- Surface resistance (membrane)
- Potential jump
- Polarisation
- Current flow to external source or sink

Boundary Conditions and Loading

- Potential
- Current Density
- External (structure) potential
- Polarisation (as a function of time, current, potential, depth, flow, velocity)
- Linear polarisation
- Point, line and volume current sources

Geometry Features

- Implicit symmetry about any axis
- General zoning and substructuring

Material Properties

- The electrolyte can be represented by zones of differing conductivity/ resistivity

Quality Assurance - Verification Tests

The predictive power and capabilities of BEASY have been verified through measurements and comparisons with CP performance data. Full details of verification studies and tests are provided in the User Guide and have been published.

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