Overview

The advent and increased availability of computers has revolutionized the worlds of science, engineering, and business since their introduction 50 years ago and their explosion in the last decade to include sizes from personal computers through supercomputers In the field of corrosion, computers are used for field monitoring, data collection and storage, cathodic protection system control, and modeling of corrosion phenomena and effects The last area of modeling was the subject of an ASTM Symposium on Computer Modeling in Corrosion held in San Antonio, Texas, on 12–13 November 1990 The symposium was sponsored by ASTM Committee G-1 on Corrosion of Metals and Subcommittee G01 03 on Computers Most of the papers presented at the symposiums are published in this volume

The papers were divided into three sections based upon their topics The papers in the section covering Surface Phenomena and Localized Corrosion describe the modeling of microscopic corrosion phenomena The first paper, by *Pye and Golestaneh*, describes the representation of corroding systems by various equivalent electric circuits and their comparison using Nyquist plots for their ac-response behavior *Newman et al* investigated dealloying by computer simulation of the behavior of individual atoms in the crystal lattice, determining certain rules which affect its dissolution probability *Attia* discusses work on the synergism of crevice and fretting corrosion mechanisms with thermal considerations *Shoji et al* modeled the stress corrosion cracking phenomena of materials in liquid water reactors *Palus and Nienart* used polarization measurement techniques and computer modeling to investigate the effect of filming inhibitors The microscopic processes and chemistry on electrodes in carbon dioxide-saturated solutions was modeled by *Turgoose et al*

The second section presents papers on Corrosion Data Fitting and Modeling of Electrode Kinetics and Impedance The computation of corrosion macrocell current distribution and electrochemical impedance of reinforcing steel in concrete is discussed by *Kranc and Sagues* Papers by *Tretheway and Keenan* and by *Devereux and Yeum* each used computational techniques to model polarization behaviors of metal/electrolyte systems, the former extending such to scale modeling and painted metals, the latter concentrating on the contributing reactions and using numerical regression to determine the contributions of each to total current density *Bertocci and Ricker* also modeled polarization behaviors but using an impedance representation of the phenomena *Anderson* used computer methods to store and evaluate data of corroding systems *Mansfeld and Shih* presented two papers to describe computer software for evaluating corrosion phenomena and coating effectiveness using electrochemical impedance spectroscopy (EIS) Methods for analyzing EIS data computationally were developed by *Roberge* using computational probabilistic models to predict long-term localized corrosion phenomena

The final section describes work in Spatial Corrosion Modeling *Munn* presents an overview of the historical development of computational techniques to predict corrosion states throughout a macroscopic galvanic system *Strømmen* described the application of computational methods to the design of cathodic protection systems for fixed offshore structures The specifics of one such spatial corrosion modeling technique, the boundary element method, was presented by *Adey and Niku DeGiorgi et al* described their application to impressed current cathodic protection system designs for ships *Carvalho et al* investigated computationally and experimentally the relative effect of certain parameters on the effectiveness of cathodic protection systems.

It was the intent of the symposium to bring together for an interchange of experiences corrosion practitioners who were using computational modeling to meet their responsibilities in product or installation design, failure analysis, education, or pure science Although the symposium was divided into three sessions by topical nature, it was clear by the discussions that the technical

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exchange across these arbitrary divisions will certainly be of benefit to those who attended This Special Technical Publication presents most of the papers offered in the symposium, and its purpose is to more widely disseminate their content The computational hardware and software available today provide considerable power to the practicing corrosionist to perform design, analysis, and research more quickly and completely than was possible before computers

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