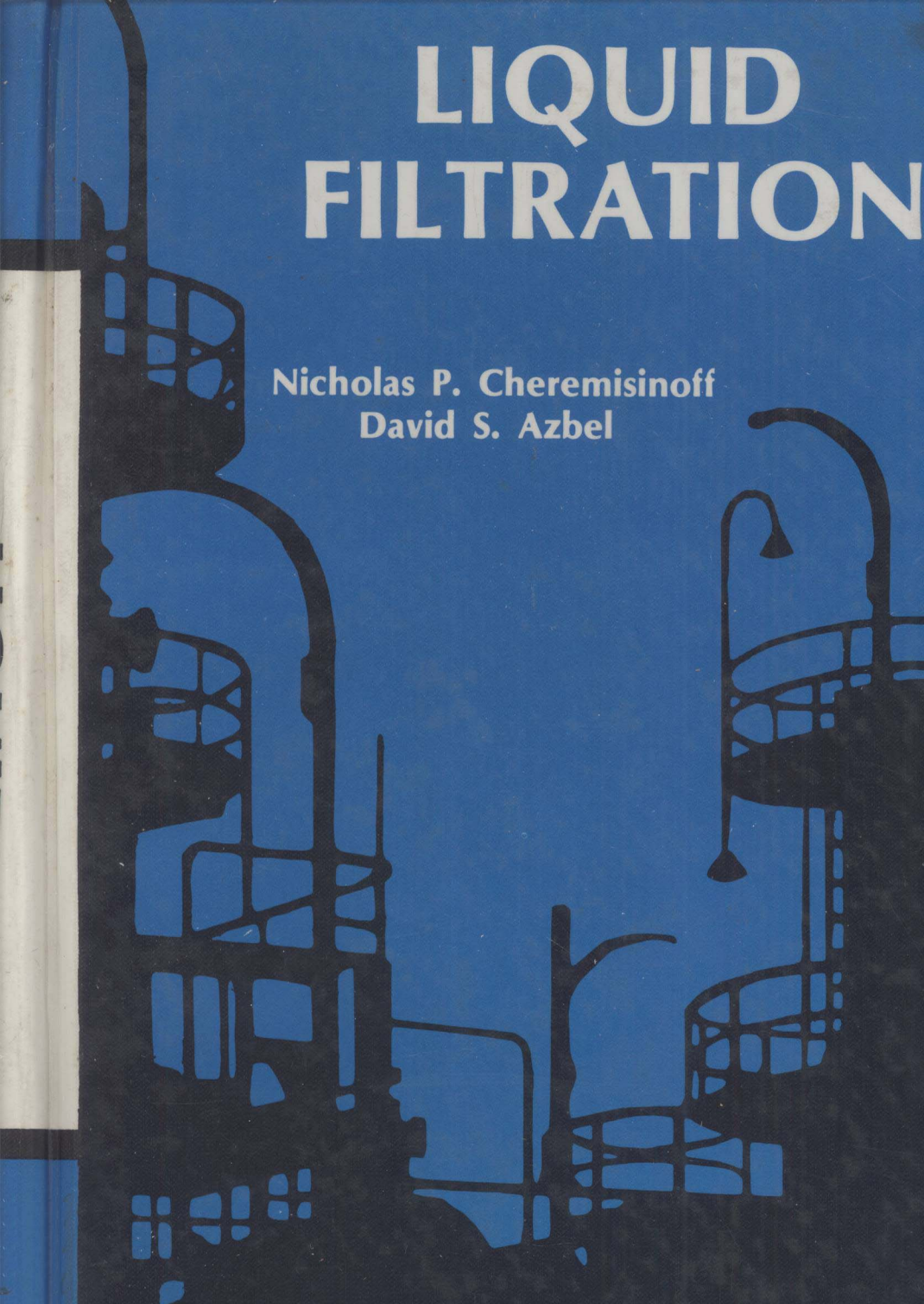
LIQUID FILTRATION

Nicholas P. Cheremisinoff
David S. Azbel



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Nicholas P. Cheremisinoff
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PREFACE

Liquid filtration is a fundamental unit operation extensively practiced throughout the chemical process, petroleum and allied industries. Technically, it involves the separation, removal and collection of a discrete phase of matter existing in a dispersed or colloidal state in suspension. This separation is most often performed in the presence of a complex media structure in which physical, physicochemical and/or electrokinetic forces interact.

Filtration as applied to liquid process streams can be for the purposes of recovering a valuable discrete phase product; recovering valuable continuum or liquid phase product; preconditioning either liquid process streams or solid, semisolid or emulsion phase materials; or removing unwanted discrete phase contaminants that may damage downstream process equipment or be harmful to the receiving/discharge environment.

Because of the diversified range of applications and properties of suspensions handled, a multitude of filtration equipment and techniques has evolved. Unfortunately, due to the complex hydrodynamics of filtration and its auxiliary operations, equipment design, selection and implementation are often confusing. Existing design methodologies are, for the most part, empirical. This empiricism has often led to mis-design or the implementation of equipment whose actual performance has fallen below anticipated operating demands.

This book is a state-of-the-art review of liquid filtration in the chemical process and allied industries. Interpretations of the phenomenological observations of the hydrodynamics of filtration are given in the hopes of establishing more theoretical and generalized bases for design methodology. Specific design and selection criteria are reviewed, and typical industrial problems and their solutions are presented. This volume marks the second in the series entitled *Chemical and Process Equipment Design*.

Several chapters have been prepared by specialists. These include Paul N. Cheremisinoff and Angelo LaMendola of New Jersey Institute of Technology (Chapter 14 on reverse osmosis), and Theodore Meltzer, Howard Green, Robert Williams and Charles Gelman of Gelman Sciences Inc. (Chapters 12,

13 and 15 on microporous membrane filtration and microfiltration). Finally, the authors extend their heartfelt gratitude to the many organizations that contributed time and materials to this volume.

Nicholas P. Cheremisinoff
David S. Azbel

Cheremisinoff

Azbel

Nicholas P. Cheremisinoff heads the Reactor and Fluid Dynamics Modelling Group in the Chemical Engineering Technology Division of Exxon Research and Engineering Company, Florham Park, New Jersey. His research and engineering activities involve atomization, fluid bed reactor design, shale oil development, coal gasification, instrumentation development, and process equipment design and enhancement. Dr. Cheremisinoff received his BS, MS and PhD in Chemical Engineering from Clarkson College of Technology. He is the author of several Ann Arbor Science books, including *Cooling Towers: Selection, Design and Practice; Fluid Flow: Pumps, Pipes and Channels;* and *Gasohol for Energy Production*. In addition, he is the author of numerous papers and is a member of several professional and honor societies including AIChE, Tau Beta Pi and Sigma Xi.

David S. Azbel is Professor of Chemical Engineering at the University of Missouri–Rolla. He was previously Research Professor at the State University of New York at Stony Brook and Visiting Professor at the University of Minnesota. From 1966 to 1972 he was Professor of Chemical Engineering at the All-Union Polytechnical Institute (Moscow, USSR); from 1961 to 1965, Chief of the Technology Department of the Organic and Synthetic Products Research Institute (Moscow, USSR); previously he was project chief at the Chemical Engineering Research Institute and Petrochemical Research Institute (Irkutsk, Siberia, USSR). Dr. Azbel graduated from Moscow Institute of Chemical Engineering and received his Doctor of Science degree from Mendeleev Institute of Chemical Technology, Moscow, USSR. Dr. Azbel's engineering, design, research and teaching span the broadest range of chemical, petroleum and nuclear experience.

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