perception; the *intellectual* on which we inquire and come to understand; the *rational* on which we reflect and pass judgment; and the *responsible* level where we are concerned to evaluate and decide. Intelligence takes us beyond experience to ask what and why; reasonableness wants to know if the answers of intelligence are true; responsibility goes beyond fact and possibility to ask what is good and hence what should be put into practice. In the sense that this pattern is not tied to categories or cultural background it is transcendental and forms an objective, normative pattern of the dynamics of conscious enquiry. It must admit of further extensions and clarifications but in one sense it does not admit of revision. For a revision which destroyed the pattern would have to come from without and so be no revision but a rejection, since revision using the methods of the pattern to reject the pattern would reject itself. This transcendental method has to be worked out in a given discipline in the categories which are appropriate to that discipline. However in any context it will function in a variety of ways—normatively, critically, dialectically, systematically. It provides continuity without rigidity, guiding inquiry and laying a sound foundation.

By now the reader will be frothing at the gills "If this is what the fellow means by being more explicitly conscious of methodology, what hope is there for us? He hasn't even talked about a practical method yet." Agreed—but then Lonergan scarcely mentions God in his "Method in theology". However, just as there is a need to articulate this in detail with respect to the particular techniques of chemical engineering (as, for example, Rudd and his colleagues have done for design synthesis [13] so also is there a need to look at the foundations [14] of our style of thinking. This may lead to philosophy in the technical sense rather than in the colloquial. In the chemical engineering literature we have Rase's excellent introduction to the chemical engineering outlook [15]; in the philosophical literature there is a long tradition that has been alluded to only glancingly here—more recent modes are well described by Bochenski [16]. At all events it is not philosophy in isolation and its development and application should produce a heightened consciousness of what the chemical engineer is actually doing and help him, or her, to do it the more effectively.

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ChE book reviews

Mixing—Principles and Applications
by Shinji Nagata
Reviewed by Louis J. Jacobs, Jr., Monsanto Co., St. Louis, Missouri.

This book is a comprehensive coverage of mixing and processing of fluids in agitated vessels. A good balance between theory and practice is provided with several examples given to demonstrate use of the correlations. The late Professor Nagata of Kyoto University was one of the most active researchers in many facets of the field of mixing over the past thirty years. His qualifications to do a book of this type are without question, and we are fortunate that his manuscript was completed prior to his recent death. This book serves many purposes providing, (1) a good introduction for persons new to the mixing field, (2) a basis for people doing further research in mixing, and (3) a source of practical information for people designing mixing processes. I highly recommend this book for persons with each of these three interests.

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simple and direct means of solving quite complex problems leaving the student free to concentrate on the actual physical nature of the system. □

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NOMENCLATURE

A_w	Heat transfer area on water side	L^2
A_s	Heat transfer area on steam side	L^2
A_v	Valve fractional opening	
C_w	Heat capacity of water	$L^2T^{-1}\theta^{-1}$
C_m	Heat capacity of metal	$L^2T^{-1}\theta^{-1}$
F_s	Flow rate of steam	MT^{-1}
ΔH	Latent heat of vapourization	L^2T^{-2}
K	Valve coefficient	LT
M_w	Mass of water in vessel	M
M_m	Mass of metal in jacket wall	M
M_s	Mass of steam in jacket	M
P_o	Pressure of steam source	$ML^{-1}T^{-2}$
P_s	Pressure of steam in jacket	$ML^{-1}T^{-2}$
Q_s	Heat transfer rate from steam	ML^2T^{-3}
Q_w	Heat transfer rate at water side	ML^2T^{-3}
R	Gas constant	$ML^2T^{-2}\theta^{-1}$
T_m	Temperature of metal wall	θ
T_s	Temperature of steam	θ
T_w	Water temperature	θ
U_w	Heat transfer coefficient on water side	$MT^{-3}\theta^{-1}$
U_s	Heat transfer coefficient on steam side	$MT^{-3}\theta^{-1}$
V	Steam jacket volume	L^3

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BOOK REVIEWS

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A chapter on power consumption of mixing impellers reviews some of the theory, gives guidance on measuring power on small scale equipment and then extensively covers the prediction of power consumption for various impellers in large scale equipment both for baffled and unbaffled vessels and Newtonian and non-Newtonian fluids.

In the chapter on heat transfer some modifications to common correlations are presented, including additional geometric parameters. These new forms correlate well the published data for turbulent heat transfer which had previously been correlated with equations having differing exponents. Heat transfer from viscous fluids using anchor or helical ribbon impellers is well covered.

Three chapters deal with flow modeling theory, as well as data for calculating mixing times, and circulation rates continuing the balance between theory and practical design information.

Four chapters are devoted to nonhomogeneous agitation operations: solid-liquid, immissible liquid contacting, and gas-liquid processing. Quantitative information is presented, but the correlations are not as well defined and substantiated as those for power and heat transfer.

A final chapter is called "Applications" which is a qualitative overview of the whole subject of mixing. This chapter is a good summary for developing an understanding of the field of mixing, but is void of any quanitative design information.

While I highly recommend this book, it does have limitations, some of which are acknowledged by the author. For a book titled "Mixing" there is no real discussion of pipeline or static mixing techniques, which is presently one of the most active areas of mixing interest. Mixing of very high viscosity materials, greater than about 1000 poise, is also excluded. Lists of nomenclature are found at the end of each chapter, but they are not all inclusive, and symbols and units are a source of confusion throughout the book. Some of the text reads a little rough, which may be due to translation from Japanese. For those looking for accurate design and scale-up methods for all mixing equipment the book will not completely satisfy the need. Mixing operations are very dependent on geometry of the particular system which makes generalizations difficult. There remains a need for considerable judgment among existing methods and techniques. This book can provide a good source from which to exercise that judgment.