cooled aero engine, it is perhaps surprising that the discussion
should be virtually confined to liquid-cooled engines. Chaps. IX
and X deal respectively with engine friction and pumping losses
and with types of compressor and exhaust turbines. In Chap.
XI, which discusses the effect of cylinder size on performance,
some striking comparisons justify the simple analysis which
indicates that bhp/in.² of piston area should be nearly inde-
pendent of cylinder size. The effect of decreasing cylinder size
for a given total engine displacement is mentioned, but one would
have welcomed some discussion of the related topic of bore/stroke
ratio, particularly in view of the marked trend toward “over-
square” cylinders shown in the author's Fig. 12.3(d) in the fol-
lowing chapter.

Chap. XIII, on the performance of supercharged engines,
gives an impression of undue condensation, although the illustra-
tive examples are valuable. To your reviewer it seems a pity to
omit any mention of methods of predicting the performance of
a supercharged aero engine at altitude (obsolescent though the
type may be), especially when this might logically follow the
excellent treatment of volumetric efficiency given in Chap. VI.
The Bibliography is an excellent one.

These minor and personal criticisms apart, the book can be
confidently recommended as a major and significant contribution
to the literature of the internal-combustion engine.

Analog and Digital Computers
Handbook of Automation, Computation, and Control, vol. II. By Eugene
M. Grabbe, Simon Ramo, and D. E. Wooldridge. John Wiley &
Sons, Inc., New York, N. Y., 1959. Cloth 6 × 10 in., xxiii and
1070 pp. $17.50.

REVIEWED BY JOHN R. WARD

This second volume of a three-volume handbook maintains
the level of excellence achieved in the first volume, which was
reviewed in the September, 1959, issue of the JOURNAL OF AP-
PLIED MECHANICS.

A wide coverage of the principles of design, application, and
programming of analog and digital machines is presented with,
naturally, a heavy emphasis on the digital instrument. Ap-
lications are restricted to computation and data processing,
since the control aspect is to be covered in the third volume.
Somewhat more applied than the first volume, reference is fre-
quently made to systems and circuits currently in use.

Once again the treatment is extremely concise, permitting a
rapid review of any particular area, a review which may be deep-
ened by way of the useful and extensive references provided.

This volume belongs beside its forerunner.

Transport Phenomena
6 × 10 in., xxiii and 750 pp. $13.75.

REVIEWED BY D. B. SPALDING

The activities of the Wisconsin group of chemical engineers
in strengthening the foundations and developing the structure
of the theory of transport phenomena have attracted considerable
attention in teaching circles. The publication of the present
handsome volume is therefore an important occasion and an
opportunity for appraising the work which has been accomplished.

The authors take the view that the transport of momentum,
energy, and material ought to be considered as a single subject
which should rank with thermodynamics, mechanics, and other
basic engineering sciences. Despite the facts that the law of
conservation of momentum is incompletely similar to those of
energy and matter, and that radiative transfer is a tiresome
anomaly, there is much to be said for this view. The authors
exploit its possibilities to the full, emphasizing and re-emphasi-
sing the similarities between the three types of transport phe-
nomena by parallel treatment and by cross-referencing.

Since they are writing what would normally be three books
within one pair of covers, and since they have clearly resolved to
discuss thoroughly every topic that they treat at all, it is in-
evitable that the book fails to cover all the ground which it has
been customary to require undergraduate and postgraduate stu-
dents of fluid mechanics, heat transfer, and mass transfer to know
about; additional texts will be needed in every case. Since there
are numerous suitable texts available for fluid mechanics and heat
transfer, gaps in those subjects (or rather branches of the subject)
can easily be filled. It is more questionable, however, whether the
student can pass easily from Bird, Stewart, and Lightfoot’s
section on mass transfer to the relatively few alternative works on
the subject; for the authors have not here provided many bridges
leading to the traditional procedures of chemical engineers. Nor,
which is perhaps more surprising in view of their interests in
mathematical techniques and in “similarities,” have they made
connection with the studies of fuel combustion and of ablation
made in the past decade; they do not mention the important
class of problems involving simultaneous heat transfer, mass
transfer, and chemical reaction which are rendered soluble by
the assumption of a Lewis number of unity.

Because of the relative newness of mass transfer as a scien-
tific discipline, the reviewer has concentrated on this portion of
the book; he opened the book with two questions in mind:
Have the authors succeeded in the important task of effecting
a smooth juncture between the subjects of mass transfer and
fluid mechanics, so that the resources of aerodynamic theory
(particularly boundary-layer theory) can be freely used by chemi-
cal engineers? And have they made accessible to undergraduates
(and their teachers) the relevant advances in the theory of multi-
component gases as represented by the book of Hirscheifelder,
Curran, and Bird?

The answer cannot, in the reviewer’s opinion, be an unquali-
fied affirmative in either case. To take the second question first,
the authors give their greatest attention to binary mixtures where
they do an excellent job; they also explain clearly the influence
of the choice of reference plane (mass-centered or mole-centered)
on the magnitude of the diffusion flux. Yet most practical
diffusion problems take place in multicomponent mixtures, and
something of more relevance to these might have been expected
than a brief citation of some of the results of Hirschfelder, et al.,
followed by a single application to a one-dimensional three-com-
ponent problem.

To tackle now the second question, the authors do make an
approach to boundary-layer theory; they treat the flat plate in
laminar flow with a binary mixture in which all fluid properties
are uniform. However, the reader may be left in doubt as to how
to proceed when these properties are not uniform, if only because
in one attack on the problem the authors’ concentration variable
is the molar density, while in the second it is the mole fraction.
Which should be used when a density gradient is present? In
the reviewer’s opinion the answer is: neither; for, since the so-
lution of the momentum equation only gives the mass-flux den-