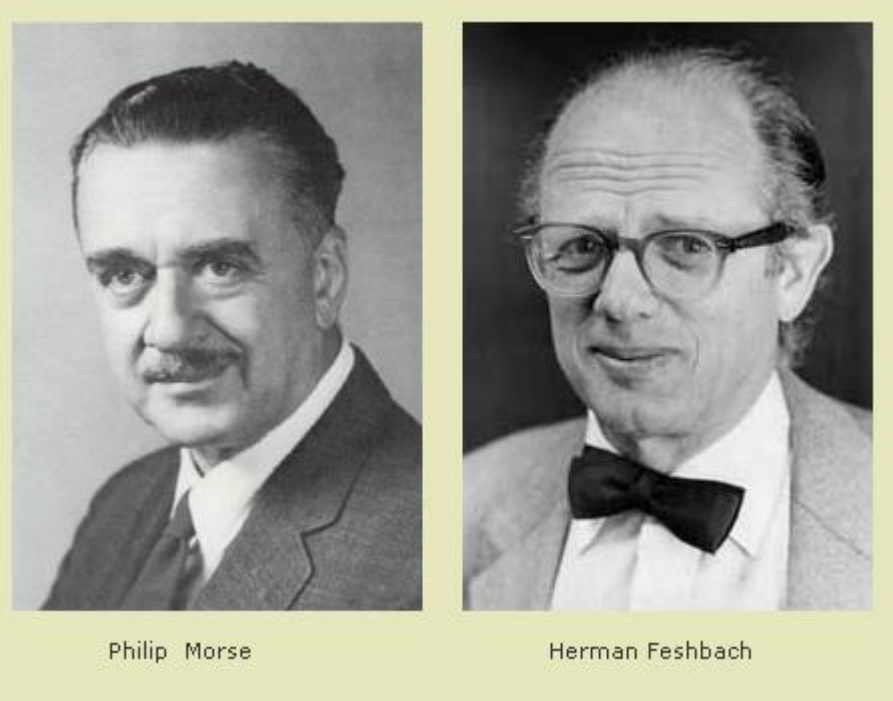
Preface PhL 1.13.12

Morse and Feshbach were MIT Physics professors. Feshbach is the younger.



Philip Morse (1903-1985) died in Concord, MA. He invented "operations research" which means data-driven analytic decision making, important in WW II. Princeton PhD 1929. Worked with Sommerfeld. Started MIT in 1931. A definite Mucky-Muck Jason and manager type. His OR work was against the German U-boats, how do you stop them! In addition to M&F, he wrote a QM book with Condon. a thermal physics book, and some acoustics books. Maybe his job was detecting submarines!

Herman Feshbach (1917-2000) was about 14 years younger than Morse. PhD MIT in 1942. He founded Union of Concerned Scientists and dealt with nuclear cold war issues. In addition to M&F, he wrote a book on nuclear physics. It is the Feshbach family that has a website to sell the reprinted books for $250.

http://www.feshbachpublishing.com/

I had an email com and learned there is no errata.

So Morse was 50 in 1953, and Feshbach was maybe 36.

Preface says they "taught the course for 16 years", on or the other. I think they invented the "math methods" title for courses. Field theory is their focus. Book is about math tools. They call it a "treatise". Only some underlying physics is even mentioned. This is not a math book on theorems, so no real rigor. Mention of "it can be shown". Examples will not be trivial, they will be complicated. Comments on choice of references. Comment on their selection of symbols and mention of the symbol glossary.

Mention of the stereo pictures. Thanks to grad students who took their courses since 1935. They ask for reports of errors (so where is the errata??)

No comments about how someone might use this book in a course! First year grad student they say might use the book. But this would be a 4 year course, 2000 pages jammed with equations and problems etc. They claim it is complete and self-contained.

Here is a review written **1956 by Mark Kac,** and it has some negative comments with which I agree somewhat. I might also add that many of their symbols seem overly elaborate, fancy German script letters no one can write on a blackboard, and the dyad stuff is just not for me. Perhaps simple matrix/linear algebra was just not well known at this time, I am confused by that.

Methods of theoretical physics. By P. M. Morse and H. Feshbach. New York, McGraw-Hill, 1953. Part I, 22+998+40 pp.; Part II, 18+979 pp. $30.00 a set.

The present two-volume book is a gigantic compendium of methods of mathematical physics. It is truly staggering in scope and one cannot but admire the authors for accomplishing a task of this magnitude. The two most notable features are: 1. an excellent account of the Wiener-Hopf technique with many important applications; 2. a systematic use of the Green's function technique in dealing with differential equations of physics.

The arrangement of material follows a "handbook" pattern, i.e. the methods and techniques are not necessarily arranged according to logical interconnections but rather according to their specific use

in physical theories. Thus mathematics is strongly subordinated to physical application and, because of this, methods tend to appear as "tricks" and the book as a collection of the latter rather than the former. This subordination, which was doubtless intentional, tends to emphasize the "handbook" character of the work and makes it less effective as a textbook. It also makes the book much more useful than inspiring. But if usefulness was the purpose of the authors they have achieved it to such a degree that the book will, for many years to come, be an indispensable addition to the bookshelf of everyone who might be even mildly concerned with mathematical physics.

A specific topical review of a book of nearly 2000 pages is clearly impossible. Even the table of contents is too lengthy for reproduction. Suffice it to say that all standard tools of both classical and modern physics, with the exception of group theory and probability theory, are at least touched upon. (Theory of matrices is apparently presupposed because there is no systematic presentation, but matrices are used throughout the book.) The principal emphasis is on differential equations. In some cases the authors have striven to completeness beyond and above the call of duty, such as the coverage of both the tensor and dyadic notations or the scrupulously detailed discussion of separation of variables in less common coordinate systems. The style is lucid and the level of mathematical rigour quite adequate for a work of this kind.

Each chapter ends with a list of extremely well selected problems and an excellent bibliography. Many chapters have been appended by summarizing tables and lists. For instance, Chapter II ends with a list of standard forms of some of the partial differential equations of theoretical physics, Chapter III with a tabulation of variational methods and Chapter XI with a short table of Laplace transforms.

There are curious omissions and inadequacies. For instance, the Huyghens principle is discussed briefly (one page!) in the chapter on Green's functions but never mentioned in an exhaustive (250 pages!) chapter on the wave equation. Nowhere is there even a hint that the principle is wrong in even-dimensional spaces. The method of steepest descent, so important in statistical physics, is treated briefly in the chapter on complex variables with a relatively simple example. It is then applied twice or three times in even simpler situations. Neither the example nor the applications contain a warning as to how mathematically delicate the method becomes as soon as one leaves the elementary realm. The whole question of continuous spectra is dealt with in a most cursory manner and in general one feels that the authors have tried to stay away from situations where

conceptual difficulties exceeded the purely technical ones.

Since the book is destined to play an important part in the mathematical education of future physicists it is perhaps not inappropriate to take issue with the authors on the "philosophy" underlying their approach. Throughout history mathematics has served physics in dual capacity: (a) as a tool for obtaining numerical answers, (b) as an aid to deeper understanding and logical evaluation of the generalizations and abstractions one tends to draw from experiment and experience. Although no sharp line can be drawn between (a) and (b) the two aspects are clearly distinguishable especially if pushed to extremes. The authors have concentrated on (a) to such an extent that (b) is all but absent or lost. Thus in spite of the richness of material and the meticulous care taken in its presentation the reviewer feels that the work is inadequate as a treatise or even a textbook on mathematical methods of physics. It is a "super handbook" and an invaluable reference source, but with all its excellent features it somehow lacks cohesiveness and structure. If this book should become the "Riemann-Weber" of the twentieth century the reviewer will regretfully and nostalgically look back to the nineteenth.

MARK KAC

Now that I am done reviewing the thing, I do think it has value for me in this sense: when I want to learn details of some particular "math method" because I am studying some area of physics that uses that method (eg, stellar structure) I might come back to M&F and look at some of their examples which use that same method. I think I know where to find things now in M&F.

So as a handbook, this M&F is a little bit like the Lebedev book of 500 problems some of what are solved by Lebedev (and friends). But M&F has very many more words! It is the theory plus problems, not just the problems.