Book Review

Perturbation Methods in Heat Transfer, by A. Aziz and T. Y. Na, Hemisphere Publishing Corporation, New York, 1984, 199 pp., $37.50.

Professors Aziz and Na have provided a very useful heat transfer text that will interest students and practioners alike. As its title suggests, the contents focus on the application of perturbation methods to a wide range of heat transfer problems. This limitation is a considerable virture as the book is just under 200 pages in length and moves along at a rapid pace.

Aside from basic concepts, the first chapter introduces a large number of practical heat transfer examples that broadly survey the subject. Most of these examples are solved in the second chapter, which provides a comprehensive treatment of regular perturbation methods; elementary examples such as algebraic or simple ordinary differential equations, are treated first. This exemplary procedure is maintained in the subsequent chapters.

The third chapter introduces the concept and reasons for singular perturbation procedures. Chapters four and five treat this type of problem with the method of strained coordinates and matched asymptotic expansions, respectively. Unfortunately, the treatment of matched asymptotic expansions is too perfunctory. The systematic method for determining the gauge functions of the inner and outer expansions is not explained. The reader is thus unaware of the occasional necessity, for example, of terms of order $\epsilon \ln \epsilon$. Methods for forming a uniformly valid composite expansion are also not treated. The last chapter is a brief presentation of the series extension method, locating and moving of singularities, and related topics.

On the whole, the book admirably fills a large void in the heat transfer literature. It is, however, seriously marred by an inordinate number of errors that occur throughout the text. For instance, the two references I checked were both in error. In section 3.6, θ is referred to as the average temperature, whereas θ/ℓ is the average temperature. Freezing in a finite slab, section 5.4, is first formulated in terms of two independent and two dependent variables. The subsequent nondimensional formulation, however, involves three independent and three dependent variables. This abrupt change is made without any discussion or explanation.

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Laminar-Turbulent Transition, V. V. Kozlov, Editor, Springer-Verlag, New York, 1985, 795 pp., $85.00.

The five-day Second Symposium on Laminar-Turbulent Transition of the International Union of Theoretical and Applied Mechanics was held in July 1984 just outside of Novosibirsk in the Akademgorodok (Academic City, a Siberian concentration of research institutes of the Soviet Academy of Sciences) located in the center of Siberia. It was attended by 140 scientists and engineers from fourteen countries, including 14 from the United States, 10 from Japan, 85 from the Soviet Union, and 14 from other Eastern countries. The all-English proceedings contain 95 papers, including 11 twelve-page invited lectures and 33 six-page poster papers. The 759-page volume covers instabilities and transition in boundary layers (some with separation interaction), channels and pipes, free shear layers, flows between rotating shells, and even relaminarization in supersonic expansions. There are 11 predominantly Soviet papers on supersonic problems, and 4 papers involve gravity-conditioned systems. The approach is theoretical in 44 papers, experimental in 33, and combined in 5; moreover, 8 papers describe numerical experiments and 5 involve engineering correlations of experimental data.

The Symposium was organized primarily by a nucleus of experts from the Institute for Theoretical and Applied Mechanics in Novosibirsk to demonstrate Soviet progress in the stability and transition field. The 57 Soviet contributions indeed represent a unique snapshot of the Russian theoretical and experimental (!) effort *in English*. The quality ranges from excellent to poor and irrelevant, as does the quality of the non-Soviet papers. In view of the variability of quality and the wide range of topics, some perspective and guidance, albeit subjective, are in order.

Advances in data acquisition and processing and in computing have opened new experimental and theoretical vistas in this field of uncertainties. Practical utilization of linear-stability codes in design beckons. In flat-plate and mixing-layer flows, the extra capabilities have already pushed our understanding to secondary and tertiary instabilities. (For recent readable expositions and correlations see Ref. 1. Somewhat earlier com-