concepts and methodologies of a discipline, they are not prepared to imagine how the solution of nonlinear equations (for example) might apply to their discipline. The authors have recognized that interest in computer programming for students of chemical engineering might be enhanced if they could see how the solutions of general classes of problems developed in computer science courses apply to chemical engineering. Their book might be useful for supplementary reading in a course on computer programming, although it is more likely to be useful for independent study by students in their junior and senior years, or perhaps for a short course offered in a chemical engineering department.

The book is at a very elementary level in terms of both computer programming and chemical engineering. The authors discuss briefly each of several general classes of problems and present computer programs (in FORTRAN Extended Version IV) for specific problems in chemical engineering. The first chapter, on the solution of nonlinear equations, for example, includes applications such as solving the virial equation of state, bubble-point and dew-point calculations, and simple flash vaporization. Other chapters deal with simultaneous linear equations, curve fitting, numerical integration and differentiation, linear interpretation, nonlinear simultaneous equations, and plotting. □

LETTER: Dead States

Continued from page 161.

Chemical Availabilities." This choice of reference state is simple and is compatable with the existing chemical literature, in particular, data on standard free energies of formation. More complex or idiosyncratic reference states defined by European thermodynamicists [2, 3, 5] have been adopted by some U.S. authors [4].

The motivation for these complex reference states appears to be the belief that one needs to and can calculate an absolute or "actual" availability, if the "dead" state of the environment is defined. The "dead" state definition consists of a careful description of the temperature, pressure, and composition of the environment. Once a system's components match this state, the system is "dead" as far as work production in concerned.

The effort to define a "dead" state has yielded a laborious analysis of the average composition of the hydrosphere, atmosphere, and lithosphere to crustal depths [5], and atmospheric "dead" states like that reprinted in the review, wherein the atmosphere is at 100% humidity, giving the actual atmosphere a negative availability, in most places for most of the year; and where the reference state for CO_2 requires that tabulated CO_2 free energy must be corrected for the work that may, in theory but not in practice, be obtained by expanding CO_2 from one atmosphere to an assigned atmospheric partial pressure.

There is less utility in computing an "absolute" or "actual" availability, than in computing an absolute energy. The calculation of the former should be done, according to Gibbs, with respect to the "surrounding medium," that is the interacting, local, environment; which is, of course, so dynamic that it is the universal subject of conversation.

Availabilities like energies have relative magnitudes, computed with respect to reference states. A reference state, is a reference state, is a reference state, and *not* a "dead" state. If it is dead now it will quicken as soon as Summer ends (T_o = 25°C) and the fog lifts (p_{H_2O} = .03 atm).

Sincerely,
Martin V. Sussman
Tufts University

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