TABLE 1. EQUATIONS FOR FORWARD SUBSTITUTION TO OBTAIN FIGURE 2 FROM FIGURE 1

p	q
$p_1 = B_1^{-1}C_1$	$q_1 = B_1^{-1}F_1$
$p_{1,4} = B_1^{-1}C_{1,4}$	
$p_2 = (B_2 - A_2p_1)^{-1}C_2$	$q_2 = (B_2 - A_2p_1)^{-1}(F_2 - A_2q_1)$
$p_{2,4} = -(B_2 - A_2p_1)^{-1}A_2p_{1,4}$	
$p_3 = (B_3 - A_3p_2)^{-1}(C_3 - A_3p_{2,4})$	$q_3 = (B_3 - A_3p_2)^{-1}(F_3 - A_3q_2)$
$p_i = (B_i - A_ip_{i-1})^{-1}(C_i)$	$q_i = (B_i - A_ip_{i-1})^{-1}(F_i - A_iq_{i-1})$
$i = 4,5,6$	
$p_7 = (B_7 - A_7p_6 + A_{7,2}\beta_7)^{-1}C_7$	$q_7 = (B_7 - A_7p_6 + A_{7,2}\beta_7)^{-1}(F_7 - A_7q_6 + A_{7,2}\bar{\beta}_7)$

where: $\beta_7 = p_{2,4}p_4p_5p_6 - p_2p_3p_4p_5p_6$

and $\bar{\beta}_7 = -q_2 + p_2q_3 - p_2p_3q_4 + p_2p_3p_4q_5 - p_2p_3p_4p_5q_6 + p_{2,4}q_4 - p_{2,4}p_4p_5 + p_{2,4}p_4p_5q_6$

$$q_8 = (B_8 - A_8p_7)^{-1}(F_8 - A_8q_7)$$

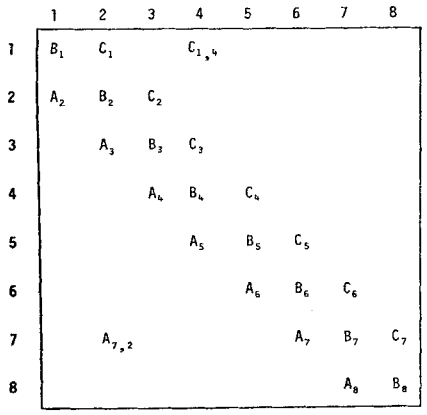

Figure 1. Example of starting matrix for case 3.

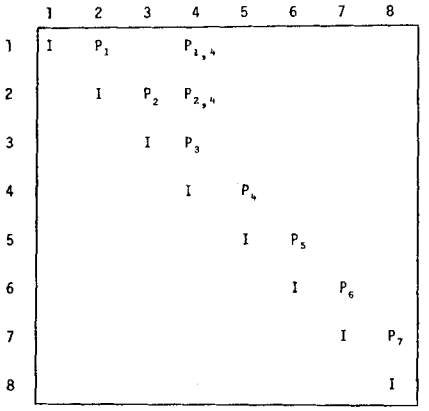

Figure 2. Matrix of Figure 1 after forward substitution.

applies only to the matrix structure given in Figure 3 of our paper, and thus is illustrative only. Similar algorithms are readily developed for other matrix structures, including the cases mentioned by Ferraris, such as: (1) where two or more nonzero blocks occur in the same column and above the tridiagonal blocks; (2) where two or more nonzero blocks occur in the same row and below the tridiagonal blocks; and (3) where a row containing a nonzero below-the-tridiagonal block and a column containing a nonzero, above-the-tridiagonal block intersect at a block that lies below the tridiagonal blocks. For example, consider Case 3 with the matrix structure shown in the attached Figure 1. The application of our technique leads to an algorithm, from which the equations for the resulting p and q elements shown in the attached Figure 2 are as listed in the attached Table 1. It does not seem to me that these equations are difficult or heavy. In fact, these equations, as well as those of Table 1 of our paper, are precisely those obtained by an LU decomposition. The new submatrix S° mentioned by Ferraris does not even enter the equations.

When many nonzero, off-tridiagonal blocks occur in the matrix structure then as discussed in the paper, "An Optimal Arrangement of Simultaneous Linearized Equations for General Systems of Interlinked, Multistaged Separators" by Hildalgo, Correa, Gomez, and me, which appears in this issue of the *AIChE Journal*, it may be more efficient to utilize standard Gaussian elimination or LU decomposition techniques rather than our technique. However, no study has been reported that quantitatively shows at what degree of matrix density it is best to just use standard techniques.

Ferraris is also concerned about I/O time of auxiliary memories. While this may be of concern with computers of very small memory, it is of little concern with today's modern computers that have either a virtual memory or a large main memory. With such computers, which are very common, the removal of submatrix E with a backward method is efficient, accurate, and presents no difficulties. For example, our technique has been applied successfully to a crude unit system consisting of a 23-stage main fractionator and three side-cut strippers containing from three to four stages each. If I/O is of concern, then a standard LU decomposition could be used where the L and U matrices are overlayed, with U being an upper unit triangular matrix (i.e. unity on the main diagonal). As mentioned above, LU decomposition leads to precisely the same equations for p and q given by our method.

J. D. SEADER
Department of Chemical Engineering
University of Utah
Salt Lake City, Utah 84112

ERRATA

In "Improving Distillation Column Design Using Thermodynamic Availability Analysis" by R. E. Fitzmorris and R. S. H. Mah [*AIChE J.*, **26**, 265 (1980)]
Equation (7a) should read

$$\beta_{hx} = q(1 - T_o/T_H) - q(1 - T_o/T_C) \quad (7a)$$

Equation (7c) should read

$$\beta_{hx} = (qT_o/T_C)(1 - T_C/T_o) + q(1 - T_o/T_H) \quad (7c)$$

Equation (8) should read

$$\beta_{hx} = T_o \int (dq/T_c) - T_o \int (dq/T_H) \quad (8)$$

Line 46, left column, p. 270 should read: "net work input as the vapor recompression . . .", not "net work input at the vapor recompression . . .".

Line 14, left column, p. 266 should read: "rate of irreversible entropy increase".

In "Oil Ganglion Dynamics During Immiscible Displacement: Model Formulation" by A. C. Payatakes, K. M. Ng and R. W. Flumerfelt [*AIChE J.*, **26**, 441 (1980)], Figure 11 appears sideways. The corrected version is shown below.

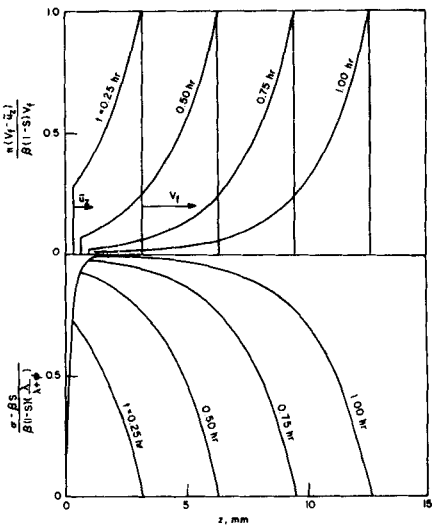

Figure 11. Traveling bulge of moving v ganglion concentration in the absence of coalescence. The corresponding stranded v ganglia concentration profile is also shown. Typical parameter values used in the calculation are: $V_f = 3.5$ μm/s, $\bar{u}_z = 0.35$ μm/s, $\lambda = 3$ mm^{-1}, $\phi = 2$ mm^{-1}.

1980 AIChE Membership Directory, American Institute of Chemical Engineers, New York (1980) 566 pp. This volume contains listings of officers of the Institute's Committees, Divisions and Local Sections, and alphabetical and geographical listings of members. Orders will be honored *only* from AIChE members. $10 (post-paid, prepaid only). Order from AIChE Publications Dept., 345 E. 47 St., New York, N.Y. 10017