$$\tan 2\phi = \frac{2b_p^{(k-1)'}\, b_q^{(k-1)}}{b_p^{(k-1)'}\, b_p^{(k-1)} - b_q^{(k-1)'}\, b_q^{(k-1)}}\,,\ \phi \in \left[-\frac{\pi}{4}, \frac{\pi}{4}\right].$$

From (1), and in an obvious notation, we have

$$\tan 2\phi = \frac{2t_p^{(k-1)'}\, A^2 t_q^{(k-1)}}{t_p^{(k-1)'}\, A^2 t_p^{(k-1)} - t_q^{(k-1)'}\, A^2 t_q^{(k-1)}}$$

This is exactly the angle of rotation required to annihilate the (p, q) element of the matrix $T^{(k-1)'} A^2 T^{(k-1)}$, that is, $[A^2]^{(k-1)}$. Thus an induction argument shows that the matrices $\{R^{(k)}\}$ generated by the two methods are identical.

Forsythe and Henrici (1960) have proved for the row-cyclic Jacobi method that

$$\lim_{k\to\infty} R^{(1)} R^{(2)} \dots R^{(k)} = T$$

where T is the matrix of unit-length column eigenvectors of the matrix under consideration. Thus, for the JK method,

$$\begin{aligned} \lim_{k\to\infty} B^{(k)} &= \lim_{k\to\infty} AR^{(1)} \dots R^{(k)} \\ &= AT \\ &= B, \text{ the required matrix.} \end{aligned}$$

This therefore establishes the convergence of the JK method.

References

FORSYTHE, G. E., and HENRICI, P. (1960). The cyclic Jacobi method for computing the principal values of a complex matrix, *Trans. Amer. Math. Soc.*, Vol. 94, pp. 1-23.

KAISER, H. F. (1972). The JK method: a procedure for finding the eigenvectors and eigenvalues of a real symmetric matrix, *The Computer Journal*, Vol. 15, pp. 271-273.

Yours faithfully

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7 March 1973

To the Editor
The Computer Journal

Sir

I should like to bring two items to your attention.

Firstly, as regards a meaning for 'SHRDLU' (this *Journal*, Vol. 16, No. 2, p. 34). In some efforts at counting the frequency of occurrence of letters from the English alphabet in 'normal' texts, the results were, in order,

ETAOIN SHRDLU . . .

This was noted, for example, by Sir Arthur Conan Doyle, in the Adventure of the Dancing Man from *The Return of Sherlock Holmes*. David Kahn, in *The Codebreakers*, gives this sequence as

ETAONI RSHDLU.

Was this also the motivation for the linotype layout?

Secondly, another reference which is related to the article *A graphical representation of the Backus-Naur form* by Chaplin, et al. (this *Journal*, Vol. 16, No. 2, pp. 28-29) is *A syntactical chart of ALGOL* 60 by Taylor, *et al.* (*Comm. ACM*, Vol. 4, No. 9 (Sept., 1961)). The point of view in the latter is 'top-down' though, while Chaplin's is 'bottom-up'.

Yours faithfully

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24 April 1973

To the Editor
The Computer Journal

Sir

Extensions to Backus Naur Motivation

I am using the Backus Naur form of notation to define the syntax of a complicated data-stream. I wish, however, to extend the B.N.F. notation by the addition of certain further conventions, and I would like to request the help of readers of the *Journal* in giving credit where credit is due for these conventions.

The first extension to the standard B.N.F. is that:

1. ⟨Item ?⟩ indicates that ⟨Item⟩ may be absent or may occur once only; e.g.

   ⟨Integer⟩ ::= ⟨Sign ?⟩ ⟨Decimal digit⟩ |
   ⟨Integer⟩⟨Decimal digit⟩

2. ⟨Item*⟩ indicates that ⟨Item⟩ is present an indefinite number of times from 1 upwards; e.g.:

   ⟨Real Number⟩ ::= ⟨Integer⟩ . ⟨Decimal digit*⟩

3. ⟨Item* ?⟩ indicates that ⟨Item⟩ is present an indefinite number of times from 0 upwards; e.g.:

   ⟨Group⟩ ::= ⟨Member* ?⟩

This extension is, I believe, due to R. A. Brooker; perhaps some-one can tell me in what it was first published, and when.

The second extension which I wish to use is that, where the number of occurrences of ⟨Item⟩ is between certain known limits, say a and b, this shall be denoted by ⟨Item⟩ $^{b}_{a}$; e.g.:

$$\begin{aligned} \langle\text{Vehicle Registration Mark}\rangle ::= {} & \langle\text{letter}\rangle^{2}_{1} \langle\text{decimal digit}\rangle^{4}_{1} \mid \\ & \langle\text{decimal digit}\rangle^{4}_{1} \langle\text{letter}\rangle^{2}_{1} \mid \\ & \langle\text{decimal digit}\rangle^{3}_{1} \langle\text{letter}\rangle^{3}_{3} \mid \\ & \langle\text{letter}\rangle^{3}_{3} \langle\text{decimal digit}\rangle^{3}_{1} \langle\text{letter ?}\rangle \end{aligned}$$

Although this would appear to be a 'natural' or 'obvious' extension of B.N.F., I do not know of any published mention of it. If it has been published, I shall be grateful to any one who can supply me with the relevant details.

Yours faithfully,

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6 June 1973

Errata

In the paper 'Interactive digital simulation on a small computer' (this *Journal*, Vol. 16, No. 2, pp. 118-121) by B. Gay and S. G. Payne, an error appeared in Figure 3. Line 18 of SUBROUTINE INTI should read:

2 DT = DTD/2 .

In the paper 'Lagrangian interpolation at the Chebyshev points $x_{n,\nu} \equiv \cos(\nu\pi/n)$, $\nu = 0(1)n$; some unnoted advantages' (this *Journal*, Vol. 15, No. 2, pp. 156-159) by H. E. Salzer, there are a number of errors connected with one of the references. On page 156, left-hand column, line-4, the reference to (1964) should be a reference to (1952); on page 159, in the first and second lines of the second Berman reference, '(1964) . . . *Izv, Vysš. Učebn. Zaved. Matematika*, No. 6, (43), pp. 10-14' should read '(1952) . . . *Doklady Akad. Nauk SSSR*, (N.S.), Vol. 87, pp. 167-170'; also on page 159, in the second line of the second Berman reference 'Vol. 30, Part 2, 1965, p. 632' should read 'Vol. 14, 1953, p. 542'.