APPENDIX A

Heine's Transformation

According to Heine[12] a matrix which can be partitioned into the form

$$\begin{bmatrix} A & B \\ B^{+} & C \end{bmatrix}$$

can be transformed to a reducible form by the equation

$$\begin{vmatrix} A & B \\ B^{+} & C \end{vmatrix} \times \begin{vmatrix} I & -A^{-1}B \\ -C^{-1}B^{+} & I \end{vmatrix} = \begin{vmatrix} A - BC^{-1}B^{+} & 0 \\ 0 & C - B^{+}A^{-1}B \end{vmatrix} \qquad (A.1)$$

The transformation allows us to get the secular equation, corresponding to the matrix, easier.

REFFERENCES

1. Onnes, H.K., Aked. van Wetenschappen (Amsterdam) 14, 113, 818 (1911).

2. Strongin, M., D.O. Welch, and J.W. Davenport, "Superconductivity at high temperatures in doped oxides," Nature, Vol. 325, pp. 664-665, 1987.

3. Kittle, C., Introduction to Solid State Physics, p. 359, Wiley Easter Limited, New Delhi, 5th ed., 1985.

4. Beasley, M.R., T.H. Geballe, "Superconducting Materials," Phys. Today, Vol. 37, No. 10, p.60, 1984.

5. Sleight, A.W., J.L.Gillson, and F.E. Bierstedt,"High Temperature Superconductivity in The $BaPb_{1-x}Bi_xO_3$ System," Solid State Commun., Vol.17, No. 1, p. 27, 1975.

6. Bednorz, J.G., and K.A. Miller, "Possible High T_c Superconductivety in the Ba-La-Cu-O System," Z. Phys., B 64, p.189, 1986.

7. Takagi, H., S. Uchida, K. Kitazawa, S. Tanaka, " High-T_c superconductivity of La-Ba-Cu Oxides. II. Specification of the superconducting phase," Jpn.J. Appl. Phys. Part 2 (Japan), Vol.26, No. 2, pp. L 123-4, 1987.

8. Cava, R.T., R.B. van Dover, B. Batlogg, and E.A. Rietman, "Bulk Superconductivity at 36 K in $La_{1.8}Sr_{0.2}CuO_4$," Phys. Rev. Lett., Vol. 58, No. 4, pp. 408-410, 1987.

9. Tanaka, S., "Possibility of two-Dimensional Superconductivity in $(La,Ba)_2$ CuO_4 and $(La,Sr)_2CuO_4$ with High Critical Temperatures", Jpn. J. Appl. Phys., Vol. 26, No. 3, pp.L 203-L 205, 1987.

10. Bardeen, J., L.N. Cooper, and J.R. Schrieffer, "Theory of Superconductivity," Phys. Rev., 108(5), pp. 1175-1204, 1957.

11. Slater, J.C., and G.F. Koster, "Simplified LCAO Method for the Periodic Potential Problem," Phys. Rev., 94(6), pp. 1498-1524, 1954.

12. Heine, V., "s-d Interaction in Transition Metals," Phys. Rev., Vol. 153, No.3, p.673, 1967.

13. Ashcroft, N.W., and N.D. Mermin, Solid State Physics (Crance, D.G.,ed.), p.143, Holt-Saunders, Japan, 1981.

14. Hove, L.V., " the Occurrence of Singularities in the Elastic Frequency Distribution of a Crystal, " Phys. Rev., 89(6), pp. 1189-1193, 1953.

15. Jahn, H.A., and E. Teller, "Stability of Polyatomic Molecules in Degenerate Electronic States," Proc. Roy. Soc., A161, pp. 220-235, 1937.

16. Tinkham, M., Introduction to Superconductivity, p.35, McGraw-Hill Book Company, ed., 1975. In the book the way to get the self-consistency condition has been shown. The condition was found to be

$$1/V = (1/2) \sum_{\vec{k}} \frac{\tanh(\beta E_{\vec{k}}/2)}{E_{\vec{k}}}$$

After changing the sum to an integral the equation becomes

$$2/V = \int_{-\hbar\omega_0}^{\hbar\omega_0} \frac{\tanh(\beta E_{\vec{k}}/2)}{E_{\vec{k}}} N(\epsilon)\,d\epsilon$$

Since $\beta = 1/k_B T$, $E_k = [(\epsilon-\mu)^2 + \Delta^2]^{1/2}$, the equation is

$$2/V = \int_{-\hbar\omega_0}^{\hbar\omega_0} \frac{\tanh\left([(\epsilon-\mu)^2+\Delta^2]^{1/2}/2k_B T\right)}{[(\epsilon-\mu)^2+\Delta^2]^{1/2}} N(\epsilon)\,d\epsilon$$

17. Labbé, J., and J. Bok, " Superconductivity in Alcaline-Earth-Substituted La_2CuO_4 : a Theoretical Model," Europhys. Lett., 3(11), 1225-1230, 1987.

18. Mattheiss, L.F., "Electronic Band Properties and Superconductivity in $La_{2-y} X_y CuO_4$," Phys. Rev. Lett., Vol.58, No.10, p. 1028, 1987.

19. Yu, J.,A.T. Freeman, and J.H. Xu, "Electronically Driven Instabilities and Superconductivity in the Layered $La_{2-x}Ba_xCuO_4$, Perovskites," Phys. Rev. Lett., Vol. 58, No. 10, p. 1035, 1987.

20. Hirsch, J.E., and D.J. Scalapino, "Enhanced Superconductivity in Quasi Two-Dimensional Systems," Phys. Rev. Lett., Vol. 56, No. 25, p. 2732, 1986.

VITA

Name	Mr. Prapat Kertbundit
Born	June 17, 1957
Degree	B.Sc. in Physics, 1983, Mahidol University, Bangkok, Thailand
Experience	Scientist at The Thai Industrial Standard Institute, Ministry of Industry.