On the Existence of a Cycloidal Burmester Theory in Planar Kinematics[1]

O. BOTTEMA.[2] The author is to be commended on having introduced a generalized theory of plane motion based on cycloidal curves, in which classical Burmester theory is included as one of several special cases. However, the descriptions in section #2 referring to Fig. 1 could perhaps be somewhat more complete for the sake of greater clarity and to facilitate understanding by the reader.

W. MEYER zur CAPELLEN[3] **and P. DANKE.**[3] It is very gratifying to observe the generalization of the classical Burmester theory in this investigation so as to include cycloidal motion, in which Burmester's theory for circular motion is contained as a special case and in which elliptical and straight-line motion is included also. The method presented by the author is developed for certain problems of dimensional kinematic synthesis and can be carried out only with the aid of modern calculating devices (computers). In this way, a departure from Burmester's purely geometric point of view is at once apparent. Burmester's geometric graphical-construction procedures or "recipes" have been replaced by a computer program, available upon request, for the solution of complex algebraic calculations—a method which has been applied for years with great success in connection with numerous problems in kinematic synthesis. Under prevailing European conditions however, the usefulness of such a program to the practitioner who needs a solution within a few hours or days is as yet limited; nevertheless, it remains to be seen whether this situation will change within a short period of time.

It would undoubtedly be useful also, to formulate these deserving developments and derivations for the case of infinitesimally separated positions of a plane, in the course of which a considerable simplification in the computations seems very likely.

Author's Closure

The author is grateful for the kind remarks of the discussers. As to Dr. Bottema's remarks, the author is glad to enlarge upon the description in section #2 of the paper as follows:

In Fig. 1 there are four planes: (i) The fixed plane, represented by the x,iy coordinate system; (ii) the "movable plane" A-a, for which several arbitrary discrete positions have been prescribed, namely, positions A_1a_1 and A_ja_j, $j = 2, 3, 4, 5, \ldots, m$; (iii) the plane represented by the rotatable vector **w**; and (iv) the plane represented by the planetary vector **g**.

Planes 3 and 4 are those that generate the exact cycloidal curve, which lies in the fixed plane of reference. Our task is to find point C in the movable A-a plane such that corresponding positions of C, namely, $C_1, C_2, \ldots C_j \ldots$ lie on a cycloidal curve, and also to find the planes **w** and **g**, which generate such curve, and can therefore be used as parts of a "cycloidal crank."

The problem specializes to the classical Burmester theory when, for example, **g** approaches zero. Then the "cycloidal curve" becomes a circle, and C becomes a "circlepoint."

The author is following up with appreciation Professor Dr. Ing. Meyer zur Capellen and P. Danke's suggestion concerning the case of infinitesimally separated positions of a plane in connection with the cycloidal theory, and is currently completing a paper on that subject, to be submitted in the near future for publication.

[1] By George N. Sandor, published in the December, 1964, issue of the Journal of Applied Mechanics, vol. 31, Trans. ASME, vol. 86, Series E, pp. 694–699.

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The Effect of Longitudinal Oscillations on Free Convection From Vertical Surfaces[1]

R. J. SCHOENHALS.[2] The authors have carried out an analysis of considerable interest in the general area of oscillating flows and are to be complimented on their treatment of the problem. The phase-angle results for small values of ω^*/ω_0^* (Figs. 3 and 4 of the paper) do not approach the large ω solutions smoothly. It appears as though an exact solution may perhaps yield curves which drop considerably below the asymptotic value beyond $\omega^*/\omega_0^* = 1$, eventually reach minimum values, and then finally rise again to approach the asymptotic value. Similar observations can be made in connection with the amplitude results shown in Figs. 5 and 6. Would the authors care to comment on these speculations? Also, it would be of interest to obtain a physical reason as to why these reversals occur if a simple explanation of the phenomena is possible.

Authors' Closure

The authors appreciate the discussion prepared by Professor Schoenhals. The speculation made regarding the general behavior of the small-frequency solution is certainly a possibility. The small-frequency expansion was not calculated for higher values of the frequency parameter because (a) the series was very slowly convergent in this range, and (b) because an expansion around the quasi-steady state was not felt to hold for higher frequencies. The abrupt approach of the two asymptotic solutions should not be regarded as being a result of the errors associated with the integral technique. Indeed, an integral procedure always predicts correct qualitative results. The abrupt approach of the two expansions is by no means unique to this problem of mixed convection. This is also encountered in free convection as well as forced convection cases under oscillating flow conditions. Only a rigorous matching procedure will eliminate this problem. The matching in this case, however, is nontrivial and is a subject of investigation all by itself.

[1] By S. Eshghy, V. S. Arpaci, and J. A. Clark, published in the March, 1965, issue of the Journal of Applied Mechanics, vol. 32, Trans. ASME, vol. 87, Series E, pp. 183–218.

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