Substitution of (R) and $(\dot{r})$ into equations (2) gave

$$
\begin{aligned}
Z_{1x} &= 2.500 & Z_{1y} &= -1.0661 \\
Z_{2x} &= -1.500 & Z_{2y} &= 0.3838 \\
Z_{3x} &= 0 & Z_{3y} &= -0.6823 \\
Z_{4x} &= 1.000 & Z_{4y} &= 0
\end{aligned}
$$

The mechanism is shown in Fig. 3 in its final position (precision point ①) with solid lines and in its initial position dashed. The output of the linkage was computed and is shown in Fig. 4.

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DISCUSSION

John R. Zimmerman[3]

Dr. McLarnan is to be complimented on presenting in such an eminently useful form the design equations for each of a large number of specific applications of the second inversion of the sliding-block chain. Individual problems can be worked readily at the desk calculator, or the whole assemblage coded into a multipurpose computer routine.

One wonders why it is that this mechanism can be applied for only four precision conditions. It is familiar knowledge that the first inversion of the sliding-block chain (i.e., the offset slider-crank mechanism) can be designed as a function generator with five precision positions (e.g., by the Burmester methods). However, here one is coordinating crank and slider movements. Still one is prescribing five successive configurations of the mechanism. It would be helpful and interesting to have some comment from the author giving us some intuitively clear reason why it turns out one can prescribe five successive configurations of the sliding-block chain in the one case and not in the other.

Author's Closure

In answer to Professor Zimmerman's question as to why the slider crank inversion may only be synthesized with four precision points while the slider crank mechanism permits five, it should be noted that, in the synthesis of the slider crank mechanism, the object is to coordinate linear motions of the slider with rotations of the input crank. Therefore different scale models of a given solution would not satisfy the same precision conditions. However, in the slider crank inversion, we are coordinating the rotations of two cranks, and therefore any scale model is also a solution to the same problem. Thus fixing the scale of the linkage could be thought of as fixing one of the mechanism parameters, thereby removing one possible precision condition. It might be noted that if the linear output of the slider crank mechanism were to be scaled in a similar fashion, such as by expressing the linear motion as a percentage of the total stroke, then only four precision conditions would be possible.

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