which is a function of motion variable $\phi$ and shape parameters $\alpha$, $\beta$ and $\theta$. We take the derivative of $f$ with respect to motion variable $\phi$ and let it equal to zero

$$f' = -as\alpha c(\phi - \beta) + hs\alpha s (\phi - \beta) - as\beta c (\phi - \alpha) - hs\beta s (\phi - \alpha) + 2hs\alpha s\beta c - 2hs\beta s\phi c\alpha = 0$$  \hspace{1cm} (12)

Equation (11) can be expressed as a linear function of $c\phi$ and $s\phi$,

$$M_1 c\phi + N_1 s\phi = 0$$  \hspace{1cm} (13)

with

$$M_1 = 2as\alpha s\beta - 3hs\alpha c\beta + 3hs\beta c\alpha$$  \hspace{1cm} (14)

$$N_1 = -as\alpha c - as\beta c\alpha$$  \hspace{1cm} (15)

Similarly, Eq. (12) can be expressed as

$$M_2 c\phi + N_2 s\phi = 0$$  \hspace{1cm} (16)

with

$$M_2 = -as\alpha c - as\beta c\alpha$$  \hspace{1cm} (17)

$$N_2 = -2as\alpha s\beta + 3hs\alpha c\beta - 3hs\beta c\alpha$$  \hspace{1cm} (18)

The system of the two equations can now be written as

$$Mq = 0$$  \hspace{1cm} (19)

with

$$M = \begin{bmatrix} M_1 & N_1 \\ M_2 & N_2 \end{bmatrix}, \quad q = \begin{bmatrix} c\phi \\ s\phi \end{bmatrix}$$  \hspace{1cm} (20)

The determinant of $M$ has to be zero, so we have

$$g = \det(M) = 0$$  \hspace{1cm} (21)