*restart*;

lambda := $b+\frac{h}{2}$;

$$b+\frac{1}{2}\,h \tag{1}$$

Lambda := *Vector*(1 ..3); Lambda[1] := 1 + epsilon·lambda;

$$\begin{bmatrix}0\\0\\0\end{bmatrix}$$

$$\varepsilon\left(b+\frac{1}{2}\,h\right)+1 \tag{2}$$

Lambda[2] := 1 + epsilon·lambda·2;

$$2\,\varepsilon\left(b+\frac{1}{2}\,h\right)+1 \tag{3}$$

Lambda[3] := 1 + epsilon·lambda·3;

$$3\,\varepsilon\left(b+\frac{1}{2}\,h\right)+1 \tag{4}$$

*S* := *Vector*(1 ..3); *S*[1] := *h*·Lambda[2]·sin(theta);
*S*[2] := *u*[2]·*h*·Lambda[3]·sin(theta);
*S*[3] := (*u*[3] + epsilon·omega·*h*)·*h*·Lambda[3]·sin(theta);

$$\begin{bmatrix}0\\0\\0\end{bmatrix}$$

$$h\left(2\,\varepsilon\left(b+\frac{1}{2}\,h\right)+1\right)\sin(\theta)$$

$$u_2\,h\left(3\,\varepsilon\left(b+\frac{1}{2}\,h\right)+1\right)\sin(\theta)$$

$$\left(\varepsilon\,h\,\omega+u_3\right)h\left(3\,\varepsilon\left(b+\frac{1}{2}\,h\right)+1\right)\sin(\theta) \tag{5}$$

*temp* := *solve*(*S*[1] = *p*, *h*); *h* := *simplify*(*convert*(*series*(*temp*[1], epsilon, 3), *polynom*), *assume* = [sin(theta) > 0]);

$$\frac{1}{2}\,\frac{-2\,b\,\varepsilon\sin(\theta)-\sin(\theta)+\sqrt{4\sin(\theta)^2\,b^2\,\varepsilon^2+4\sin(\theta)^2\,b\,\varepsilon+4\sin(\theta)\,\varepsilon\,p+\sin(\theta)^2}}{\sin(\theta)\,\varepsilon},$$

$$-\frac{1}{2}\,\frac{2\,b\,\varepsilon\sin(\theta)+\sqrt{4\sin(\theta)^2\,b^2\,\varepsilon^2+4\sin(\theta)^2\,b\,\varepsilon+4\sin(\theta)\,\varepsilon\,p+\sin(\theta)^2}+\sin(\theta)}{\sin(\theta)\,\varepsilon}$$

$$-\frac{p\,\left(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta)\right)}{\sin(\theta)^2} \tag{6}$$

*u*[2] := *simplify*( *convert*(*series*(*solve*(*S*[2] = *q*, *u*[2]), epsilon, 2), *polynom*), *assume* = [sin(theta)

$> 0]);$

$$-\frac{1}{2}\frac{q\left(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-2\sin(\theta)\right)}{\sin(\theta)\,p} \tag{7}$$

$u[3] := simplify(convert(series(solve(S[3]=r, u[3]), \text{epsilon}, 2), polynom), assume=[\sin(\text{theta}) > 0]);$

$$-\frac{1}{2}\frac{2\sin(\theta)\,b\,\varepsilon\,r+2\,\varepsilon\,\omega\,p^2+\varepsilon\,p\,r-2\,r\sin(\theta)}{\sin(\theta)\,p} \tag{8}$$

$f := Vector(1..3); f[1] := simplify(convert(series(u[2]\cdot h\cdot \text{Lambda}[1]\cdot\sin(\text{theta}), \text{epsilon}, 2), polynom), assume=[\sin(\text{theta}) > 0]);$

$$\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$-\frac{q\left(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta)\right)}{\sin(\theta)} \tag{9}$$

$f[2] := simplify\left(convert\left(series\left(\left(u[2]^2+\frac{\text{epsilon}\cdot\text{psi}\cdot h}{2}\right)\cdot h\cdot\text{Lambda}[2]\cdot\sin(\text{theta}), \text{epsilon}, 2\right), polynom\right), assume=[\sin(\text{theta}) > 0]\right);$

$$-\frac{1}{2}\frac{4\sin(\theta)\,b\,\varepsilon\,q^2-\varepsilon\,p^3\,\psi+2\,\varepsilon\,p\,q^2-2\,q^2\sin(\theta)}{p\sin(\theta)} \tag{10}$$

$f[3] := simplify(convert(series(u[2]\cdot(u[3]+\text{epsilon}\cdot\text{omega}\cdot h)\cdot h\cdot\text{Lambda}[2]\cdot\sin(\text{theta}), \text{epsilon}, 2), polynom), assume=[\sin(\text{theta}) > 0]);$

$$-\frac{q\,r\left(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta)\right)}{\sin(\theta)\,p} \tag{11}$$

$with(VectorCalculus) : M := Jacobian([f[1], f[2], f[3]], [p, q, r]);$

$$\left[\left[-\frac{q\,\varepsilon}{\sin(\theta)}, -\frac{2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta)}{\sin(\theta)}, 0\right],\right.$$
$$\left[-\frac{1}{2}\frac{-3\,\varepsilon\,p^2\,\psi+2\,\varepsilon\,q^2}{p\sin(\theta)}+\frac{1}{2}\frac{4\sin(\theta)\,b\,\varepsilon\,q^2-\varepsilon\,p^3\,\psi+2\,\varepsilon\,p\,q^2-2\,q^2\sin(\theta)}{p^2\sin(\theta)},\right.$$
$$\left.-\frac{1}{2}\frac{8\sin(\theta)\,b\,\varepsilon\,q+4\,\varepsilon\,p\,q-4\,q\sin(\theta)}{p\sin(\theta)}, 0\right],$$
$$\left[-\frac{q\,r\,\varepsilon}{\sin(\theta)\,p}+\frac{q\,r\left(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta)\right)}{\sin(\theta)\,p^2}, -\frac{r\left(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta)\right)}{\sin(\theta)\,p},\right.$$
$$\left.\left.-\frac{q\left(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta)\right)}{\sin(\theta)\,p}\right]\right] \tag{12}$$

$with(LinearAlgebra) : E := simplify(Eigenvalues(M), assume=[\sin(\text{theta}) > 0]);$

$$\left[\left[-\frac{q\,(2\,b\,\varepsilon\sin(\theta)+\varepsilon\,p-\sin(\theta))}{\sin(\theta)\,p}\right],\right.$$
$$\left[-\frac{1}{2}\,\frac{1}{p\sin(\theta)}\Big(4\sin(\theta)\,b\,\varepsilon\,q+3\,\varepsilon\,p\,q-2\,q\sin(\theta)\right.$$
$$\left.-\sqrt{-\varepsilon\,p^2\,(8\sin(\theta)\,b\,\varepsilon\,p\,\psi+4\,\varepsilon\,p^2\,\psi-4\sin(\theta)\,p\,\psi-\varepsilon\,q^2)}\Big)\right],$$
$$\left[-\frac{1}{2}\,\frac{1}{p\sin(\theta)}\Big(4\sin(\theta)\,b\,\varepsilon\,q+3\,\varepsilon\,p\,q-2\,q\sin(\theta)\right.$$
$$\left.\left.+\sqrt{-\varepsilon\,p^2\,(8\sin(\theta)\,b\,\varepsilon\,p\,\psi+4\,\varepsilon\,p^2\,\psi-4\sin(\theta)\,p\,\psi-\varepsilon\,q^2)}\Big)\right]\right] \quad \textbf{(13)}$$

$E[3]$

$$-\frac{1}{2}\,\frac{1}{p\sin(\theta)}\Big(4\sin(\theta)\,b\,\varepsilon\,q+3\,\varepsilon\,p\,q-2\,q\sin(\theta)$$
$$+\sqrt{-\varepsilon\,p^2\,(8\sin(\theta)\,b\,\varepsilon\,p\,\psi+4\,\varepsilon\,p^2\,\psi-4\sin(\theta)\,p\,\psi-\varepsilon\,q^2)}\Big) \quad \textbf{(14)}$$