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ERRATUM

Erratum to: Analysis on the nonlinear response of cracked rotor in hover flight

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In the original publication, equations (5), (9) and (10) appearing on pages 185 and 186 should read as follows.

The equations of motion of the system can be written as

$$
\begin{aligned}
&m\ddot{x} + 2mc_d\omega_t\dot{x} + k_z x \\
&\quad - f\big[\big(k_z - k_{11}\cos^2\omega t - k_{22}\sin^2\omega t\big)x \\
&\quad + \sin\omega t\cos\omega t\,(k_{22} - k_{11})y \\
&\quad + \big(-k_{13}\cos^2\omega t - k_{24}\sin^2\omega t\big)\theta_y \\
&\quad + \sin\omega t\cos\omega t\,(k_{24} - k_{13})\theta_x\big] \\
&= me\omega^2\sin(\omega t + \phi_e + \beta + \vartheta) \\
&\quad + mr_1\omega_1^2\cos\vartheta - mg\sin\vartheta, \\
&m\ddot{y} + 2mc_d\omega_t\dot{y} + k_z y - f\big[\sin\omega t\cos\omega t\,(k_{22} - k_{11})x \\
&\quad + \big(k_z - k_{11}\sin^2\omega t - k_{22}\cos^2\omega t\big)y \\
&\quad + \sin\omega t\cos\omega t\,(k_{24} - k_{13})\theta_y \\
&\quad + \big(-k_{13}\sin^2\omega t - k_{24}\cos^2\omega t\big)\theta_x\big] \\
&= me\omega^2\cos(\omega t + \phi + \beta + \vartheta) - mr_1\omega_1^2\sin\vartheta \\
&\quad - mg\cos\vartheta, \qquad (5) \\
&J_d\ddot{\theta}_y + 2J_dc_1\omega_s\dot{\theta}_y - J_p\omega\dot{\theta}_x + k_\theta\theta_y \\
&\quad - f\big[\big(-k_{13}\cos^2\omega t - k_{24}\sin^2\omega t\big)x \\
&\quad + \sin\omega t\cos\omega t\,(k_{24} - k_{13})y \\
&\quad + \big(k_\theta - k_{33}\cos^2\omega t - k_{44}\sin^2\omega t\big)\theta_y \\
&\quad + \sin\omega t\cos\omega t\,(k_{44} - k_{33})\theta_x\big] \\
&= J_p\omega\omega_1\sin\vartheta, \\
&J_d\ddot{\theta}_x + 2J_dc_1\omega_s\dot{\theta}_x + J_p\omega\dot{\theta}_y + k_\theta\theta_x \\
&\quad - f\big[\sin\omega t\cos\omega t\,(k_{24} - k_{13})x \\
&\quad + \big(-k_{13}\sin^2\omega t - k_{24}\cos^2\omega t\big)y \\
&\quad + \sin\omega t\cos\omega t\,(k_{44} - k_{33})\theta_x \\
&\quad + \big(k_\theta - k_{33}\sin^2\omega t - k_{44}\cos^2\omega t\big)\theta_y\big] \\
&= J_p\omega\omega_1\cos\vartheta
\end{aligned}
$$

where m is the mass of disc, k_z is the bending stiffness of the uncracked rotor, and k_θ is the angular stiffness. ϕ_e is the original phase angle. c_d and c_1 are transverse

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and swing vibration damps, respectively. f is the crack model function. ω_t and ω_s are transverse and swing vibration critical speeds, respectively. k_{ij} is the cross stiffness when the crack is open (the force in direction i caused the unit bending in direction j, 1, 2, 3 and 4 represent the direction of x, y, θ_y and θ_x, respectively) [1].

$$\begin{aligned}
&X'' + \frac{2c_d}{\Omega}X' + \frac{1}{\Omega^2}X - \frac{f}{\Omega^2} \\
&\quad \times \Big[\big(1 - \breve{k}_{11}\cos^2\tau - \breve{k}_{22}\sin^2\tau\big)X \\
&\quad + \sin\tau\cos\tau\big(\breve{k}_{22} - \breve{k}_{11}\big)Y \\
&\quad + \big(-\breve{k}_{13}\cos^2\tau - \breve{k}_{24}\sin^2\tau\big)\frac{\theta_y}{\delta} \\
&\quad + \sin\tau\cos\tau\big(\breve{k}_{24} - \breve{k}_{13}\big)\frac{\theta_x}{\delta} \Big] \\
&\quad = U\sin(\tau + \phi_e + \beta + \vartheta) + R_1\frac{\Omega_1^2}{\Omega^2}\cos\vartheta \\
&\quad - \frac{1}{\Omega^2}\sin\vartheta, \\
&Y'' + \frac{2c_d}{\Omega}Y' + \frac{1}{\Omega^2}Y - \frac{f}{\Omega^2}\Big[\sin\tau\cos\tau\big(\breve{k}_{22} - \breve{k}_{11}\big)X \\
&\quad + \big(1 - \breve{k}_{11}\sin^2\tau - \breve{k}_{22}\cos^2\tau\big)Y \\
&\quad + \sin\tau\cos\tau\big(\breve{k}_{24} - \hat{k}_{13}\big)\frac{\theta_y}{\delta} \\
&\quad + \big(-\breve{k}_{13}\sin^2\tau - \breve{k}_{24}\cos^2\tau\big)\frac{\theta_x}{\delta} \Big] \\
&\quad = U\sin(\tau + \phi_e + \beta + \vartheta) - R_1\frac{\Omega_1^2}{\Omega^2}\sin\vartheta \\
&\quad - \frac{1}{\Omega^2}\cos\vartheta, \qquad (9) \\
&\theta_y'' + \frac{2c_1\Omega_s}{\Omega}\theta_y' - 2\theta_x' \\
&\quad - \frac{\Omega_s^2 f}{\Omega^2}\big[\big(-\breve{k}_{13}\cos^2\tau - \breve{k}_{24}\sin^2\tau\big)X\delta \\
&\quad + \sin\tau\cos\tau\big(\breve{k}_{24} - \breve{k}_{13}\big)Y\delta \\
&\quad + \big(1 - \breve{k}_{33}\cos^2\tau - \breve{k}_{44}\sin^2\tau\big)\theta_y \\
&\quad + \sin\tau\cos\tau\big(\breve{k}_{44} - \breve{k}_{33}\big)\theta_x\big] + \frac{\Omega_s^2}{\Omega^2}\theta_y \\
&\quad = 2\frac{\Omega_1}{\Omega}\sin\vartheta, \\
&\theta_x'' + \frac{2c_1\Omega_s}{\Omega}\theta_x' + 2\theta_y' \\
&\quad - \frac{\Omega_s^2 f}{\Omega^2}\big[\sin\tau\cos\tau\big(\breve{k}_{24} - \breve{k}_{13}\big)X\delta \\
&\quad + \big(-\breve{k}_{13}\sin^2\tau - \breve{k}_{24}\cos^2\tau\big)Y\delta \\
&\quad + \sin\tau\cos\tau\big(\breve{k}_{44} - \breve{k}_{33}\big)\theta_y \\
&\quad + \big(1 - \breve{k}_{33}\sin^2\tau - \breve{k}_{44}\cos^2\tau\big)\theta_x\big] + \frac{\Omega_s^2}{\Omega^2}\theta_x \\
&\quad = 2\frac{\Omega_1}{\Omega}\cos\vartheta
\end{aligned}$$

where

$$\begin{aligned}
&(') = \frac{\mathrm{d}}{\mathrm{d}\tau}, \quad X = \frac{x}{\delta}, \quad Y = \frac{y}{\delta}, \quad \Omega = \frac{\omega}{\omega_t}, \\
&\Omega_s = \frac{\omega_s}{\omega_t}, \quad \breve{k}_{ij} = \frac{k_{ij}}{k_z}, \quad \tau = \omega t, \qquad (10) \\
&U = \frac{e}{\delta}, \quad R_1 = \frac{r_1}{\delta}, \quad \Omega_1 = \frac{\omega_1}{\omega_t}.
\end{aligned}$$

The equations were wrong by our carelessness when we were writing another paper and the simulation results of the original publication are acceptable.

References

1. Yang, Y.F., Ren, X.M., Qin, W.Y.: Answering two questions concerning stiffness of a Jeffcott rotor with transverse crack. J. Northwest. Polytech. Univ. **24**, 778–781 (2006)