# Errata

## DYNAMICS OF ROTATING MACHINES

**Michael I Friswell, John E T Penny, Seamus D Garvey and Arthur W Lees**

**Cambridge University Press, 2010, 512 pp., ISBN 9780521850162**

**Page 98:** At the bottom of the page it is stated that, "with $\lambda_1 > \lambda_2$ then the semiminor and semimajor axes are given by $\sqrt{\lambda_1}$ and $\sqrt{\lambda_2}$ respectively". This should read "are given by $\sqrt{\lambda_2}$ and $\sqrt{\lambda_1}$ respectively".

**Page 100, last line:** 28.58Hz should be 29.58Hz.

**Problem 4.9:** The spring stiffness is placed between coordinates 2 and 3 in the answer, rather than 1 and 3 as it is in the question.

**Section 5.4.2:** In Equation (5.36), $\kappa_e$ should not be squared.

**Problem 5.5:** The shaft length should be 300mm not 300m long.

**Problem 5.11:** The answers will depend on whether the mass of the hole is included in the disc model or not. Please see the solutions manual for further details.

**Equation (6.41):** The expression for $\varphi_0$ is incorrect. The correct expression is

$$\varphi_0 = \frac{\beta}{D}(-m\Omega^2 + jc_T\Omega + k_T)(I_d - I_p)\Omega^2$$

**Example 6.2.2, Solution Part (a):** In the expression for $k_T$, *EI* should be 21,597Nm$^2$. Also the expression for $k_T$ is incorrect, the powers of 0.55 should be 3 rather than 2. Hence,

$$k_T = 3\times 21{,}597\times(0.55^3 + 0.55^3)/(0.55^3\times 0.55^3) = 0.7788\times 10^6\text{N/m}$$

Since the coupling is zero these errors do not affect the calculation of the steady state rotational response.

**Example 6.2.2, Solution Part (b):** The solution contains many errors in the expressions for the stiffness, and also due to the error in Eq. (6.41). Hence the whole correct solution is given here.

(b) Given $a = 0.8$m and $b = 0.3$m, using Appendix 2 gives

$$k_T = 3\times 21{,}597\times(0.8^3 + 0.3^3)/(0.8^3\times 0.3^3) = 2.5262\times 10^6\text{N/m}$$

$$k_C = 3\times 21{,}597\times(0.8^2 - 0.3^2)/(0.8^2\times 0.3^2) = 6.1866\times 10^5\text{N/m}$$

$$k_R = 3\times 21{,}597\times(0.8 + 0.3)/(0.8\times 0.3) = 2.9696\times 10^5\text{N/m}$$

Because $k_C \neq 0$, we must use Equation (6.41), which is the solution of Equation (6.40). Thus,

$$D = \left(k_R - \left(I_d - I_p\right)\Omega^2\right)\left(k_T - m\Omega^2\right) - k_C^2 = -3.0313\times10^{11}$$

$$r_0 = -\,k_C\left(I_d - I_p\right)\beta\Omega^2/D = -0.002098\text{m} = -2.098\text{mm}$$

$$\varphi_0 = \left(k_T - m\Omega^2\right)\left(I_d - I_p\right)\beta\Omega^2/D = -0.000759\text{rad} = -0.0435°$$

**Figure 6.16 caption:** should be ‘anisotropic’ rather than ‘isotropic’ so the full caption is “Campbell diagram for a rigid rotor on anisotropic bearings (Example 6.2.3)”

**Problem 6.6 answers:** Balancing mass should be 0.232kg.

**Problem 6.7 answers:** Response at disk should be 1.62mm, response at bearing should be 0.065mm, increased critical speed should be 4340rev/min.

**Problem 6.8 answer:** Should be 1537rev/min

**Problem 6.11:** Figures 6.63 and 6.64 were generated with the outer bearings at the end of the shaft rather than 0.1m from each end. Note that because of this Figures 6.63 and 6.64 are not consistent with the answers to Problem 5.9. For part c the critical speeds are 600, 703, 987, 1056, 1825, 2203, 2363, 2714 rev/min.

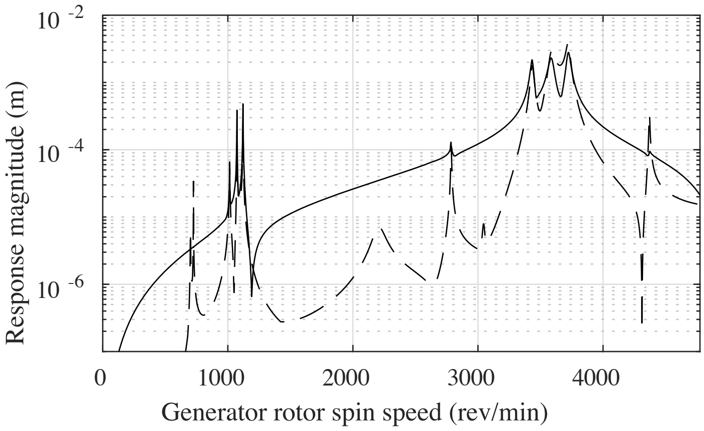
**Page 331, Equation (7.101):** The denominator for the leading constant should be element length cubed, i.e. $\dfrac{E_e I_e}{\ell_e^3}$

**Problem 7.8 answer:** Answer quoted are at 1540rev/min NOT 1520 rev/min

**Example 8.5.1 answer:** The estimated unbalances using the exact responses are accurate. However the estimated unbalances using the approximate responses given in Tables 8.4 and 8.5 should be as follows: for 3000rev/min, 0.8248g m at $-84.7°$ on disk 1, 0.1552g m at $-116.2°$ on disk 2; for 1000rev/min, 0.8871g m at $-81.1°$ on disk 1, 0.0243g m at $-7.2°$ on disk 2.

**Example 10.9.1.** The pressure angle used in this example was $\beta = 22.5°$. The question asked for the Campbell diagram and response to be calculated for a contact stiffness of 1MN/m, whereas the solution used a contact stiffness of 10MN/m; hence the stiffness in the question should be corrected. There was an error in the calculation of the response, which means that Figures 10.42 and 10.43 were incorrect; the correct figures are given below.

Correct Figure 10.42:




Correct Figure 10.43: