Supplementary material of the paper:

Elastohydrodynamic wake and wave resistance

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1 Details on the numerical solution

The surface profiles shown in the article have been obtained from the 2D inverse Fourier transform described by eq. (2.2). As a consequence, the accuracy of the results is only a function of the 2D grid in the spatial frequency domain. The grid covered the domain $Q \in \{[-Q_{max}, -Q_{min}] \cup [Q_{min}, Q_{max}]\}$, with the negative and positive sides of the grid being symmetric. For instance, the intermediate values Q_j, for $j = 1, \ldots, (N/2) - 1$, on the positive side are computed using the following relation:

$$\log_{10}\left(Q_j\right) = \log_{10}\left(Q_{min} + j\left[\frac{Q_{max} - Q_{min}}{(N/2) - 1}\right]\right) , \tag{1}$$

where N is the number of nodes in the corresponding direction.

Considering the modulus of the integrand in eq. (2.4), given by:

$$G\left(K, Q\right) = \left|\frac{\left(K^2 + Q^2\right)\exp\left[i\left(KU + QY\right) - \sqrt{B_{el}\left(K^2 + Q^2\right)}\right]}{iVK - \left(K^2 + Q^2\right)\left[1 + \left(K^2 + Q^2\right)^2\right]}\right| , \tag{2}$$

we obtain the boundaries Q_{min} and Q_{max} of the spatial frequency domain. For instance, in Fig. 1, $G\left(K, Q\right)$ has been plotted for different combinations of parameters (U, Y, V, B_{el}), at $Q = 0$ (left column) and at $K = 0$ (right column). Based on these observations, we have employed the following parameters to generate the grid in the Q-direction: $Q_{min} = 10^{-16}$ and $Q_{max} = 10^3$ being the minimum and maximum absolute values. Most of the nodes (around 89% of N) are concentrated in the region where $G\left(K, Q\right)$ shows significant values. The grid in the K-direction has been distributed likewise and with the same number N of nodes.

The number N of nodes, is the same in each direction, and has been selected after performing a convergence test. As it can be observed in Fig. 2, the solution for $\zeta\left(U, Y\right)$ at $U = 0$ and $Y = 0$ has reached its convergence value for $N = 4000$, with an error estimate on the order of 10^{-4}, for five different values of the reduced speed $V = 10^{-2}, 10^{-1}, 10^0, 10^1, 10^2$.

The same grid parameters and ranges have been employed to calculate the wave resistance R.

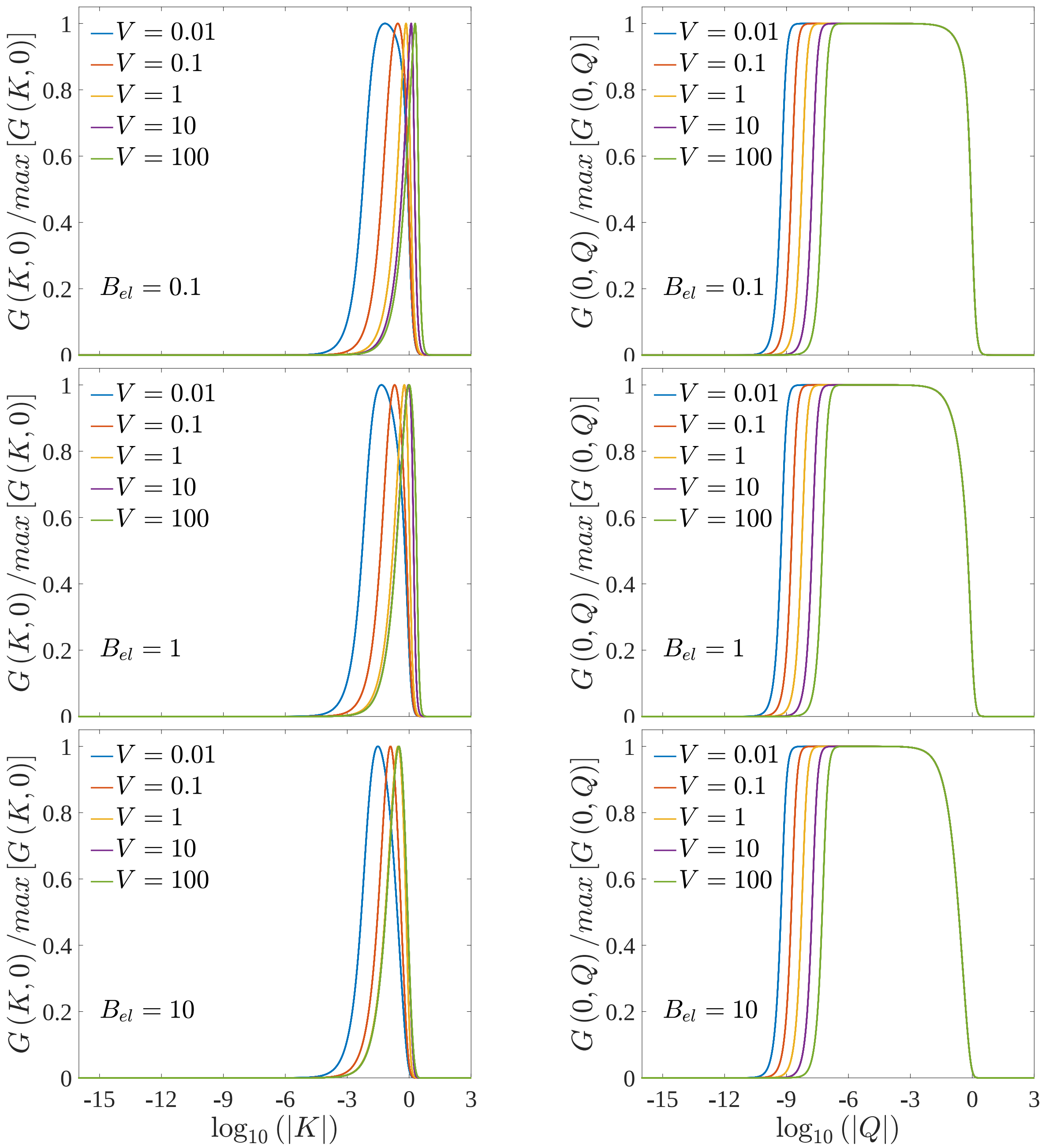

Figure 1: Normalized modulus $G(K,Q)$, given by eq. 2, as a function of K with $Q = 0$ (left column) and as a function of Q with $K = 0$ (right column). The curves obtained for different values of $U = -10, 0, 10, 20$ (left column) and $Y = 0, 5, 10$ (right column) overlap due to the normalization.

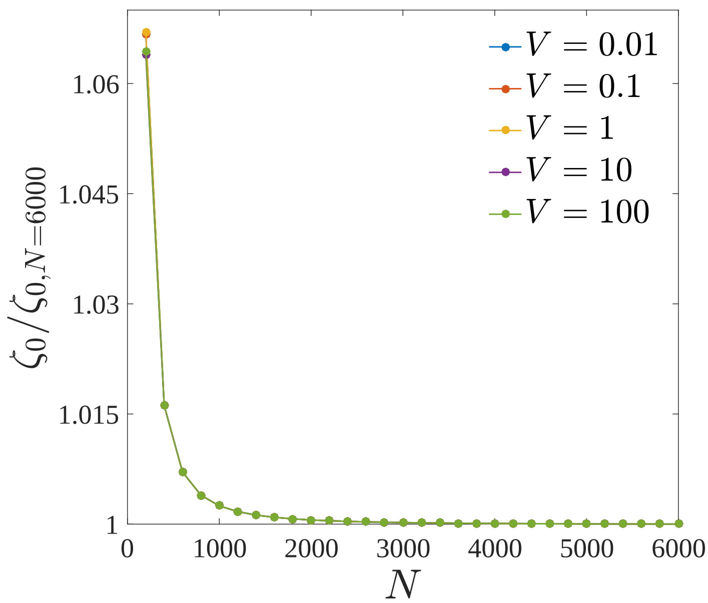

Figure 2: Normalized solution for $\zeta_0 = \zeta\,(U = 0, Y = 0)$ as a function of the number N of nodes, in both directions Q and K described in eq. (2.2). The normalization has been performed using the largest obtained value of ζ_0 with $N = 6000$ $\zeta_{0,N=6000}$. The curves obtained for different values of the reduced speed overlap due to the normalization.