

Yaw forcing with the vessel position also plotted – towards a video of 3D sloshing –

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1 Introduction

In the case of pure yaw motion with harmonic forcing, the governing equations reduce to:

$$\begin{aligned}U_t + UU_x + VU_y + gh_x &= 2\dot{\psi}V + \dot{\psi}^2(x + d_1) + \ddot{\psi}(y + d_2), \\V_t + UV_x + VV_y + gh_y &= -2\dot{\psi}U + \dot{\psi}^2(y + d_2) - \ddot{\psi}(x + d_1), \\ \psi &= \epsilon_y \sin(\omega_y t).\end{aligned}$$

Setting the parameters at $L_1 = 0.5\text{ m}$, $L_2 = 0.5\text{ m}$, $\epsilon_y = \frac{12\pi}{180}\text{ rad}$, $\omega_y = 6.0\text{ rad/sec}$, $h_0 = 0.14\text{ m}$, $\Delta x = \Delta y = 0.01\text{ m}$, $\Delta t = 0.01\text{ s}$, the snapshots of surface profile and rigid body are shown below.

In these figures the absolute position of the vessel is also shown. Hence, if the sequence of snapshots is viewed quickly one gets a view of the fluid motion and the vessel position.

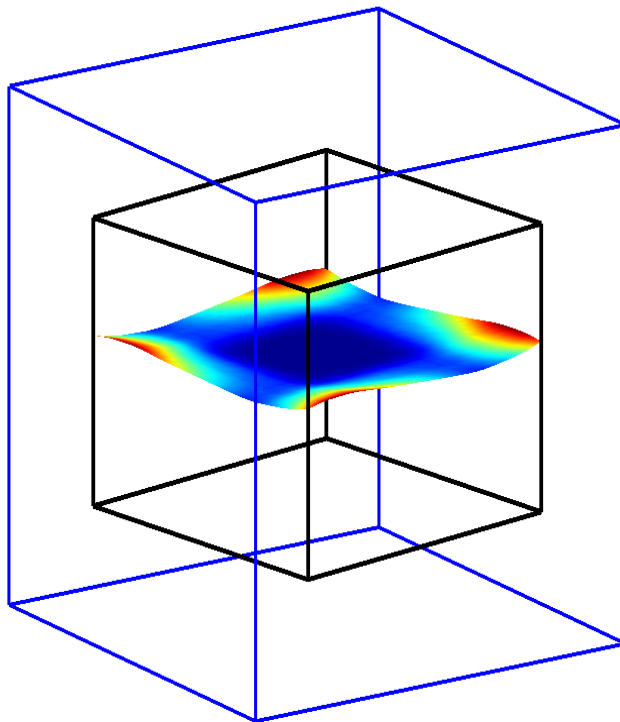


Figure 1: Snapshot of surface profile and rigid body due to yaw motion at $t = 0.15 s$.

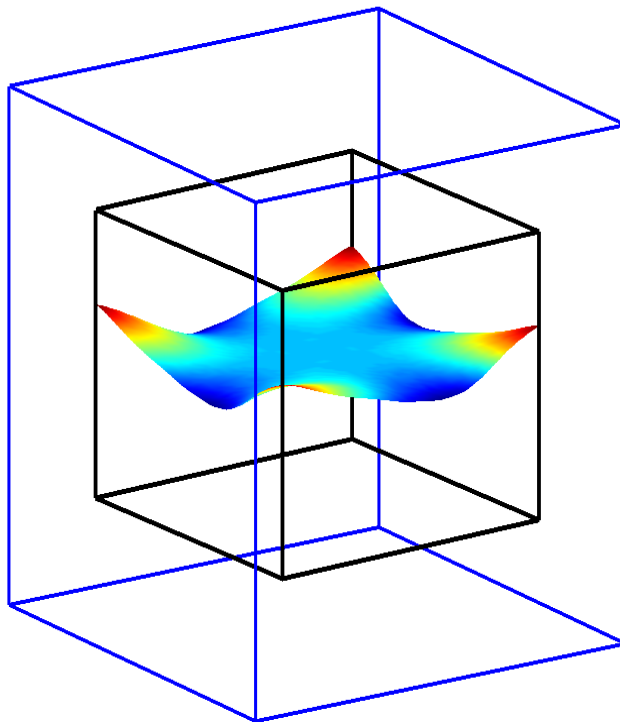


Figure 2: Snapshot of surface profile and rigid body due to yaw motion at $t = 0.50 s$.

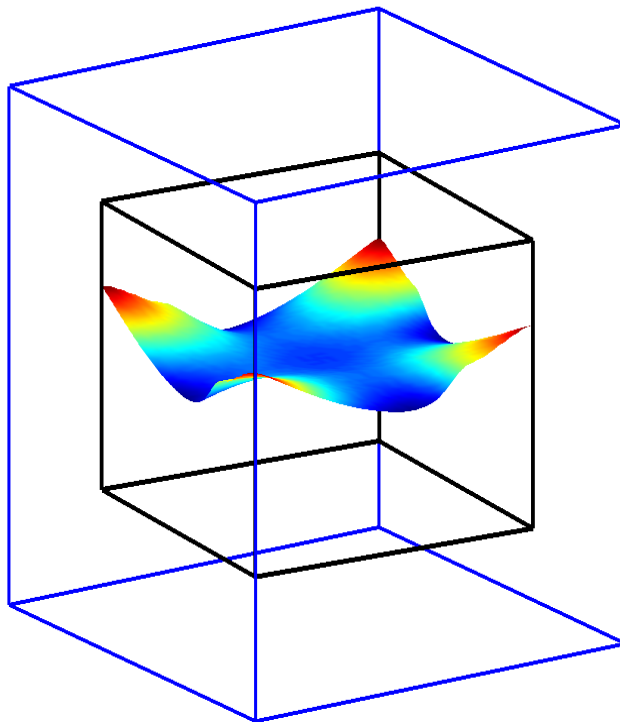


Figure 3: Snapshot of surface profile and rigid body due to yaw motion at $t = 0.60 s$.

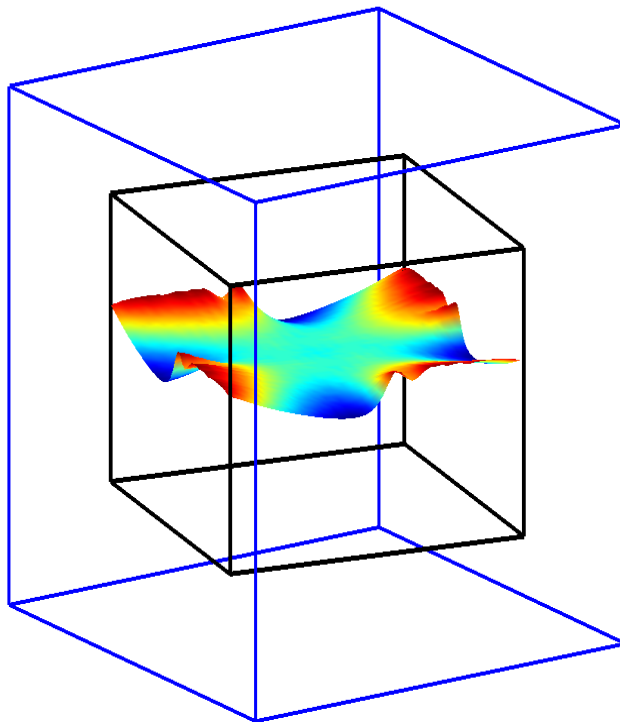


Figure 4: Snapshot of surface profile and rigid body due to yaw motion at $t = 0.75 s$.

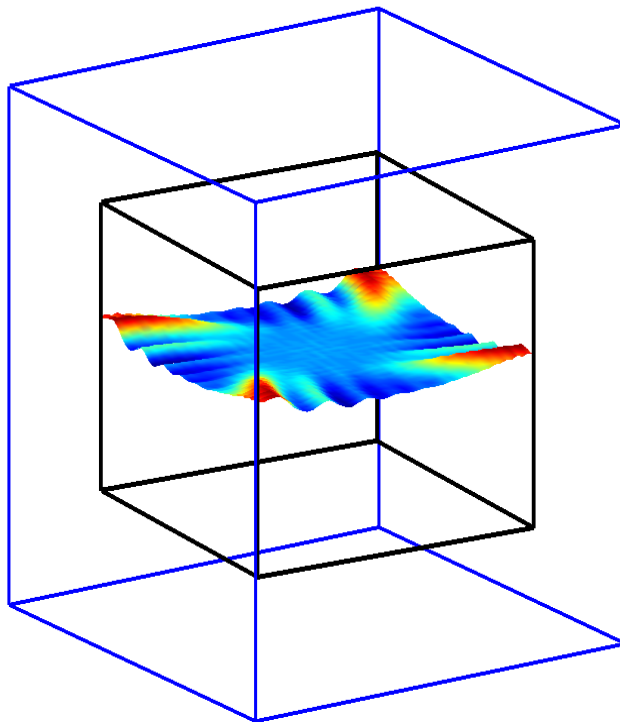


Figure 5: Snapshot of surface profile and rigid body due to yaw motion at $t = 1.0 s$.

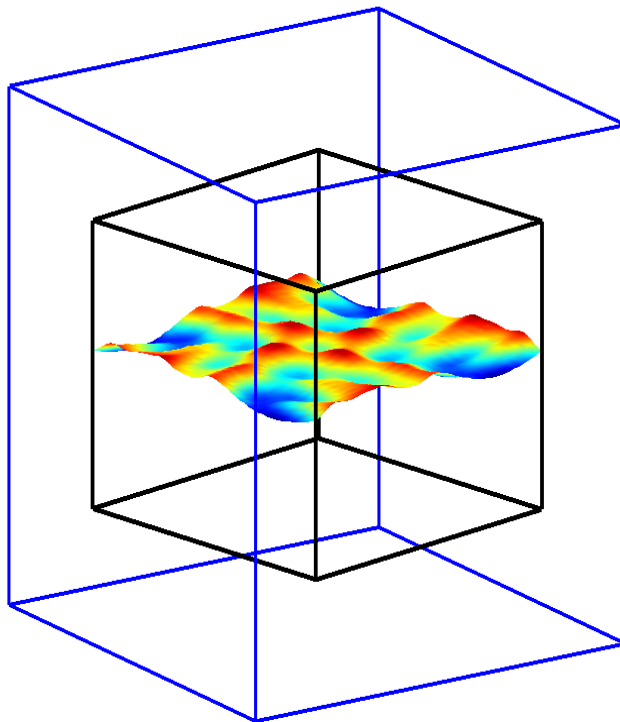


Figure 6: Snapshot of surface profile and rigid body due to yaw motion at $t = 1.25 s$.

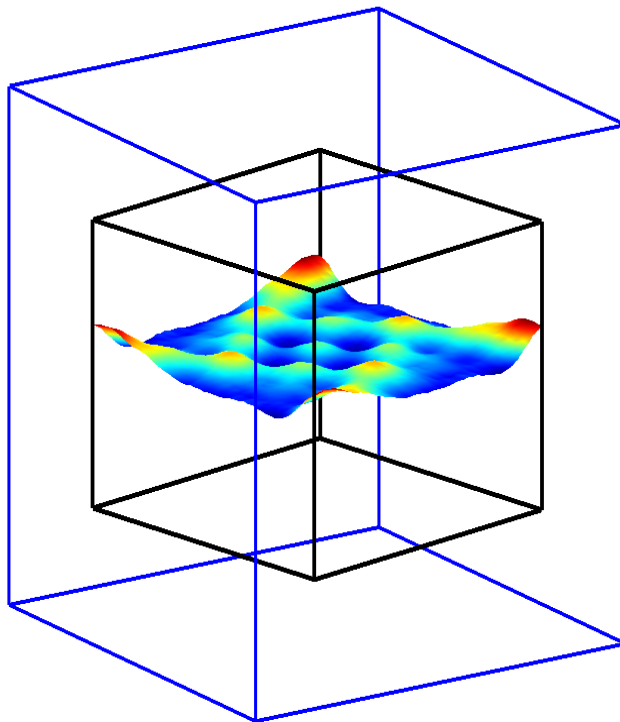


Figure 7: Snapshot of surface profile and rigid body due to yaw motion at $t = 1.40$ s.