

$phisin := \sin(n \cdot x) :$
 $phicos := \cos(n \cdot x) :$

$$An := \frac{\int \left(M \cdot phisin, x = \frac{\pi}{2} .. \pi \right)}{\int (phisin^2, x = 0 .. 2 \cdot \pi)} \text{assuming}(n > 0, n, \text{integer})$$

$$An := - \frac{M \left((-1)^n - \cos\left(\frac{n \pi}{2}\right) \right)}{n \pi} \quad (1)$$

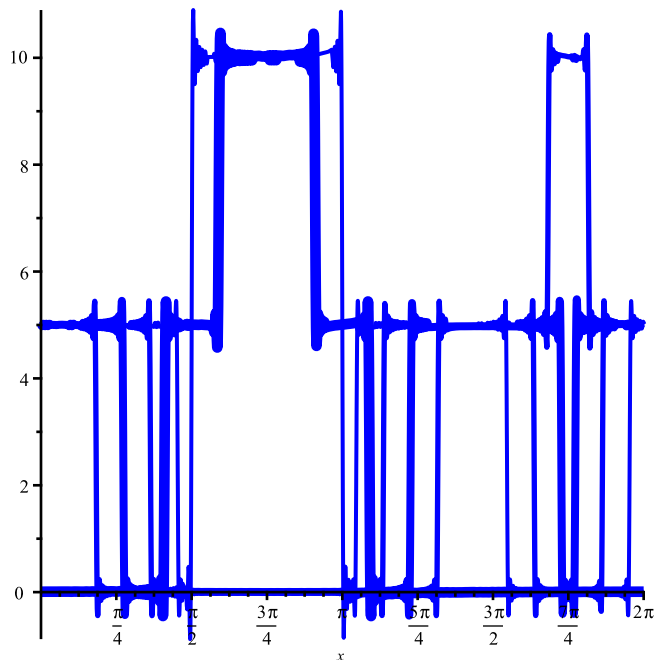
$$B0 := \frac{\int \left(M, x = \frac{\pi}{2} .. \pi \right)}{\int (1, x = 0 .. 2 \cdot \pi)}$$

$$B0 := \frac{M}{4} \quad (2)$$

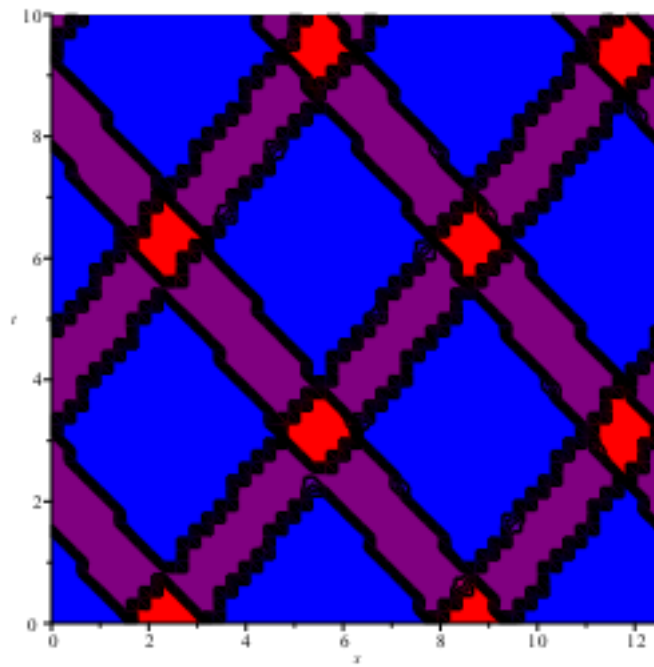
$$Bn := \frac{\int \left(M \cdot phicos, x = \frac{\pi}{2} .. \pi \right)}{\int (phicos^2, x = 0 .. 2 \cdot \pi)} \text{assuming}(n > 0, n, \text{integer})$$

$$Bn := - \frac{\sin\left(\frac{n \pi}{2}\right) M}{n \pi} \quad (3)$$

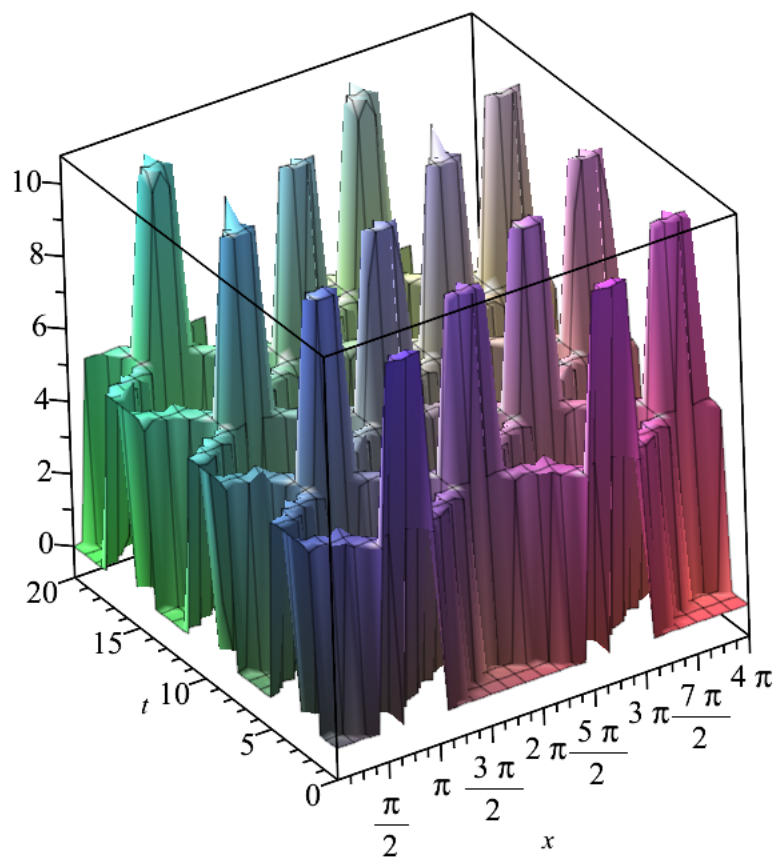
$ux := B0 + \text{sum}((An \cdot phisin + Bn \cdot phicos) \cdot \cos(n \cdot c \cdot t), n = 1 .. 200) :$
 $\text{with}(\text{plots}) :$
 $uxsubs := \text{subs}(M = 10, c = 1, ux) :$
 $\text{curves} := [\text{seq}(\text{subs}(t = 2 \cdot m, uxsubs), m = 0 .. 5)] :$
 $\text{plot}(\text{curves}, x = 0 .. 2 \cdot \pi, \text{thickness} = [1, 2, 3, 4], \text{color} = \text{blue})$



$\text{contourplot}(uxsubs, x = 0 .. 4 \cdot \pi, t = 0 .. 10, \text{coloring} = [\text{blue}, \text{red}], \text{filledregions} = \text{true})$



`plot3d(uxsubs, x=0..4*Pi, t=0..20)`



What do you notice?

We have displacement every 2π distances starting at $\pi/2$ when $t=0$. The pattern of the waves at the boundaries is always the same, but "inside" the rectangle we do not have the same wave patterns. Inside

the rectangle there is a "grid-like" shape pattern.

Why "scaling constrained" is not emphasized?

Maple automatically creates the contour plot or 3dplot in a square domain and not in the domain we specified. The "scaling constrained" command tells Maple to plot the graph in the domain we specified. "Scaling constrained" is not emphasized in this case because we have periodic boundary conditions. The displacement at the boundaries will repeat itself every 2π distances. We previously had to use the "scaling constrained" command because the boundary conditions were not periodic and we were working on the boundaries of a rectangle i.e. our function did not exist beyond this rectangle.