Aufgabe I.2.6

a) allg: $u_{p(t)} = u_p(t - mt_p) = \sum_{m=-\infty}^{\infty} u(t - mt_p)$

$$a_0 = \frac{1}{t_p}\int_{t1}^{t_2} \hat{u}_p \mathrm{dt} = \frac{1}{t_p}\Big[t \cdot \hat{u}_p\Big]_{t_1}^{t_2} = \frac{t_2 - t_1}{t_p} \cdot \hat{u}_p = B_0$$

$$a_\mu = \frac{2}{t_p}\int_{t_1}^{t_2} \hat{u}_p \cdot \cos(2\pi\mu f_0 t)\mathrm{dt} = \frac{2\hat{u}_p}{t_p}\left[\frac{1}{2\pi\mu f_0} \cdot \sin(2\pi\mu f_o t)\right]_{t_1}^{t_2} = \frac{\hat{u}_p}{\mu\pi}\Big[\sin(2\pi\mu f_o t_2) - \sin(2\pi\mu f_o t_1)\Big]$$

$$b_\mu = \frac{2}{t_p}\int_{t_1}^{t_2} \hat{u}_p \cdot \sin(2\pi\mu f_0 t)\mathrm{dt} = \frac{2\hat{u}_p}{t_p}\left[\frac{-1}{2\pi\mu f_0} \cdot \cos(2\pi\mu f_o t)\right]_{t_1}^{t_2} = \frac{\hat{u}_p}{\mu\pi}\Big[\cos(2\pi\mu f_o t_1) - \cos(2\pi\mu f_o t_2)\Big]$$

$$\begin{aligned} B_\mu &= \sqrt{a_\mu^2 + b_\mu^2} \\ &= \frac{\hat{u}_p}{\mu\pi}\sqrt{\sin(p_2)^2 - 2\cdot\sin(p_2)\sin(p_1) + \sin(p_1)^2 + \cos(p_1)^2 - 2\cdot\cos(p_1)\cos(p_2) + \cos(p_2)^2} \\ &= \frac{\hat{u}_p}{\mu\pi}\sqrt{2 - 2\sin(p_2)\sin(p_1) - 2\cos(p_1)\cos(p_2)} \end{aligned}$$

$\vdots$

$$B_\mu = \frac{\hat{u}_p}{\mu\pi}\Big|\sin(2\pi\mu f_0(t_1 - t_2))\Big| \rightarrow \text{Für gerade } \mu \text{ ist } B_\mu = 0$$

b) $\sum_{m=-\infty}^{\infty} u(t - mt_p)$

<u>gerade Symmetrie, weil achsensymmetrisch:</u>

$$a_0 = \frac{2}{t_p}\int_0^{e\frac{t_p}{2}} \hat{u}\mathrm{dt} \;\rightarrow\; a_0 = \frac{2\hat{u}}{t_p}\Big[t\Big]_0^{e\frac{t_p}{2}} = e \cdot \hat{u} = B_0$$

$$b_\mu = 0$$

$$a_\mu = \frac{4}{t_p}\int_0^{e\frac{t_p}{2}} \hat{u} \cdot \cos(2\pi\mu f_0 t)\mathrm{dt} \;\rightarrow\; a_\mu = \frac{4\hat{u}}{t_p}\left[\frac{1}{2\pi\mu f_0 t} \cdot \sin(2\pi\mu f_0 t)\right]_0^{e\frac{t_p}{2}}$$

$$a_\mu = \frac{2\hat{u}}{\mu\pi}\sin(e\mu\pi)$$

Weiß jemand wie man das Fourierspektrum als Betrag und Phase darstellt?

Ergänzung:

Si-Funktion: $\text{si}\,(x) = \dfrac{\sin(x)}{x}$ $\qquad a_\mu = 2 \cdot \hat{u} \cdot e \cdot \dfrac{\sin(e\mu\pi)}{e\mu\pi} = 2 \cdot \hat{u} \cdot e \cdot \text{si}\,(e\mu\pi)$

$$B_\mu = \sqrt{a_\mu^2 + b_\mu^2} = |a_\mu| = 2\hat{u}e \cdot |\,\text{si}\,(e\mu\pi)|$$

$$\varphi_\mu = \arctan\left(\frac{a_\mu}{b_\mu}\right) = \begin{cases} \dfrac{\pi}{2}\,, & a_\mu > 0 \\ -\dfrac{\pi}{2}\,, & a_\mu < 0 \end{cases}$$

