Num. Methods in CAE – WS 16/17 – Short solutions

Exercise 1 (9 points):

(a) $(x_1, y_1) = (16/9, 1)$

(b) $(x_1, y_1) = \frac{1}{2a}(0, 1+a^2)$. Hence $x_1 = x_2 = \ldots = 0$ and $x^* = 0$

Exercise 2 (20 points):

(a) $det(\mathbf{A}) \neq 0$

(b) $\mathbf{A}$ is strictly row diagonal dominant

(c) $\boldsymbol{x}^{(1)} = (1/2, 5/2, 15/4)$

(d) $n = 14$

(e) Worse since we can not guarantee the convergence of the SD-method.

Exercise 3 (14 points):

(a) $c_0 = \frac{p\pi^2}{6}, \quad c_1 = -p + jp\Big(-\frac{\pi}{2} + \frac{2}{\pi}\Big), \quad c_{-1} = c_1^*, \quad c_2 = \frac{p}{4} + j\,\frac{p\pi}{4}, \quad c_{-2} = c_2^*$

(b) f_p is neither even nor odd and has jump discontinuities.

(c) $c_{-k} = c_k^*$

(d) $a_0 = \frac{p\pi^2}{3}, \quad a_k = \frac{2p}{k^2}(-1)^k, \quad b_k = -p\Big(\pi\frac{(-1)^k}{k} + 2\,\frac{1-(-1)^k}{\pi k^3}\Big), \qquad k \in \mathbb{N}$

(e) $p = \frac{6}{\pi^2}$

(f) $S_{2,g}(t) \;=\; \frac{\pi^2}{6} \;-2\cos(4t) \;+\; \Big(\pi - \frac{4}{\pi}\Big)\sin(4t) \;+\; \frac{1}{2}\cos(8t) \;-\; \frac{\pi}{2}\sin(8t)$

Exercise 4 (14 points):

(a) $p_3(t) = 1 + 2t - t^2 + \frac{4}{3}t^3$

(b) $w_1 = 1 + \frac{h(2+3h)}{(1+h)^2}$

(c) $\tilde{p}_3(h) = 1 + 2h - h^2 \;\; (+\,0h^3)$