A. Quarteroni, F. Saleri, **Scientific Computing with MATLAB and Octave**, 2nd Edition. Springer Verlag, Berlin. 2006

Errata Corrige

pag. 16, row 7: the string

```
>> fplot(fun, lims, tol, n,'LineSpec',P1,P2,...)
```

should be

```
>>  fplot(fun, lims, tol, n,LineSpec)
```

pag. 27, row -19: the instruction "`v=rand(n)`" should be "`v=rand(n,1)`"
pag. 37, row -10: "Exercise 1.3" should be "Exercise 1.4"
pag. 38, row 4: the instruction "`v=roots(poly(c))`" should be "`v=roots(poly(v))`"
pag. 38, row -14: the formula

$$\pi = \sum_{m=0}^{\infty} 16^{-m} \left(\frac{4}{8m+1} - \frac{2}{8m+4} + \frac{1}{8m+5} + \frac{1}{8m+6} \right)$$

should be

$$\pi = \sum_{m=0}^{\infty} 16^{-m} \left(\frac{4}{8m+1} - \frac{2}{8m+4} - \frac{1}{8m+5} - \frac{1}{8m+6} \right)$$

pag. 46, row -11:: the phrase "In the case of zeros with multiplicity m larger than 1, the order of convergence of Newton's method downgrades to 1"
should be
"In the case of zeros with multiplicity m larger than 1, i.e. $f'(\alpha) = \ldots = f^{(m-1)}(\alpha) = 0$, Newton's method still converges, provided that $x^{(0)}$ is suitably chosen and $f'(x) \neq 0,\ \forall x \in I(\alpha) \setminus \{\alpha\}$. However, in this case, the order of convergence downgrades to 1".
pag. 51, row 13: "`x0=[-1,-1]`" should be "`x0=[-1;-1]`"
pag. 53, row -2: the assumption "*2. ϕ is differentiable in* $[a, b]$" should be "*2. ϕ is continuously differentiable in* $[a, b]$"
pag. 55, row 4: the assumption "*assume that ϕ is differentiable twice*" should be "*assume that ϕ is continuously differentiable twice*"

pag. 75, row 1: "$(n-1)/2$" should be "$(n+1)/2$"
pag. 79, row 13: the instruction "`r(n+1)=r(n+1)/prod([1:n+2]);`" should be "`r(n+1)=r(n+1)/prod([1:n+1]);`"
pag. 84, row -5: "$t_i = i\pi/100$" should be "$t_i = 2i\pi/100$"
pag. 89, row 10: the phrase "The optimal parameters" should be "The optional parameters"
pag. 91, row 13: formula

$$\max_{x\in I}|f^{(r)}(x) - s_3^{(r)}(x)| \leq C_r H^{4-r} \max_{x\in I}|f^{(4)}(x)|,\ r = 0, 1, 2, 3,$$

should be

$$\max_{x\in I}|f^{(r)}(x) - s_3^{(r)}(x)| \leq C_r H^{4-r} \max_{x\in I}|f^{(4)}(x)|,\ r = 0, 1, 2$$

and

$$\max_{x\in I\setminus\{x_0,\ldots,x_n\}}|f^{(3)}(x) - s_3^{(3)}(x)| \leq C_3 H \max_{x\in I}|f^{(4)}(x)|,$$

pag. 91, row -1: "`x=cos(t); y=sin(t);`" should be "`x=sin(t); y=cos(t);`"
pag. 93, row -10: the formula

$$\Phi(b_0, b_1) = \sum_{i=0}^{n} \left[y_i^2 + b_0^2 + b_1^2 x_i^2 + 2b_0 b_1 x_i - 2b_0 y_i - 2b_1 x_i y_i^2\right]$$

should be

$$\Phi(b_0, b_1) = \sum_{i=0}^{n} \left[y_i^2 + b_0^2 + b_1^2 x_i^2 + 2b_0 b_1 x_i - 2b_0 y_i - 2b_1 x_i y_i\right]$$

pag. 98, row -9:"November 2002" should be "November 2001"
pag. 99, row 1,2: "Compute the associated cubic interpolating spline on 4 subintervals of the temperature interval $[4, 20]$." should be "Compute the associated cubic interpolating spline on the temperature interval $[4, 20]$ subdivided in 4 subintervals."
pag. 111, row 2: "$-1/25(10\pi - 3 + 3e^{2\pi})/e^{2\pi}$" should be "$-(10\pi - 3 + 3e^{2\pi})/(25e^{2\pi})$"
pag. 133, row 6: The item "2. diagonally dominant matrices" should be "2. strictly diagonally dominant matrices"
pag. 135: algorithm (5.19)

for $k = 1, \ldots, n$
  for $i = k+1, \ldots, n$
    find $\bar{r}$ such that $|a_{\bar{r}k}^{(k)}| = \max_{r=k,\ldots,n} |a_{rk}^{(k)}|$,

    exchange row k with row $\bar{r}$,

    $l_{ik} = \dfrac{a_{ik}^{(k)}}{a_{kk}^{(k)}}$,
    for $j = k+1, \ldots, n$
      $a_{ij}^{(k+1)} = a_{ij}^{(k)} - l_{ik} a_{kj}^{(k)}$

should be

for $k = 1, \ldots, n$
  find $\bar{r}$ such that $|a_{\bar{r}k}^{(k)}| = \max_{r=k,\ldots,n} |a_{rk}^{(k)}|$,

  exchange row k with row $\bar{r}$,

  for $i = k+1, \ldots, n$
    $l_{ik} = \dfrac{a_{ik}^{(k)}}{a_{kk}^{(k)}}$,
    for $j = k+1, \ldots, n$
      $a_{ij}^{(k+1)} = a_{ij}^{(k)} - l_{ik} a_{kj}^{(k)}$

pag. 161, row 8: "see section 5.3" should be "see Remark 5.3"
pag. 162, row 15: "end of Section 8.17" should be "end of Section 8.1.2"
pag. 166, row -5: "$c_{ij} = i + j - 1$" should be "$c_{ij} = i + j$"
pag. 167: equation (6.3)

$$\mathrm{U}^* \mathrm{A} \mathrm{V} = \Sigma = \mathrm{diag}(\sigma_1, \ldots, \sigma_p) \in \mathbb{R}^{m \times n},$$

should be

$$\mathrm{U}^H \mathrm{A} \mathrm{V} = \Sigma = \mathrm{diag}(\sigma_1, \ldots, \sigma_p) \in \mathbb{R}^{m \times n},$$

pag. 176, row 6: "after 11 iterations" should be "after 19 iterations"
pag. 180, row 12: "at each $k = 1, 2, \ldots$" should be "at each $k = 0, 1, \ldots$"
pag. 181, row -5: "eigenvalues of modulus larger than `A`" should be "eigenvalues of `A` of larger modulus"

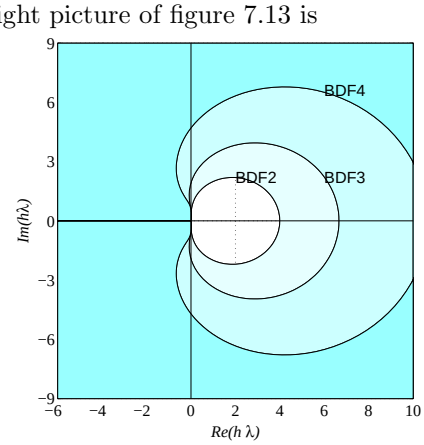
pag. 184, row 12: "$\gamma, \vartheta \in \mathbb{R}$" should be "$\gamma \in \mathbb{R} \setminus \{0\}$, $\vartheta \in \mathbb{R} \setminus \{k\pi,\ k \in \mathbb{Z}\}$"
pag. 184, row -5: "the largest negative eigenvalue of" should be " the negative eigenvalue of largest modulus of"
pag. 191, row -12: "each *node* t_n $(0 \leq n \leq N_h - 1)$" should be "each *node* $t_n = t_0 + nh$ $(1 \leq n \leq N_h)$"
pag. 194, row -10: "More in general, the local truncation error ..." should be "More in general, up to the factor $1/h$, the local truncation error ..."
pag. 198, row 9: "and expresses the error associated" should be "and, up to the factor $1/h$, it expresses the error associated"
pag. 200, row 2-3: "... is *zero-stable* if $\exists h_0 > 0$, $\exists C > 0$ such that $\forall h \in (0, h_0], \forall \varepsilon > 0$ sufficiently small, if $|\rho_n| \leq \varepsilon, 0 \leq n \leq N_h$,..."
should be
"... is *zero-stable* if $\exists h_0 > 0$, $\exists C > 0$, $\exists \varepsilon_0 > 0$ such that $\forall h \in (0, h_0], \forall \varepsilon \in (0, \varepsilon_0]$, if $|\rho_n| \leq \varepsilon, 0 \leq n \leq N_h$, ..."
pag. 207, row 6: "if $-1 \leq \lambda < 0$" should be "if $-1 < \lambda < 0$"
pag. 207, row 9: formula

$$\lim_{n\to\infty} |z_n - u_n| = \frac{\rho}{|\lambda|}$$

should be

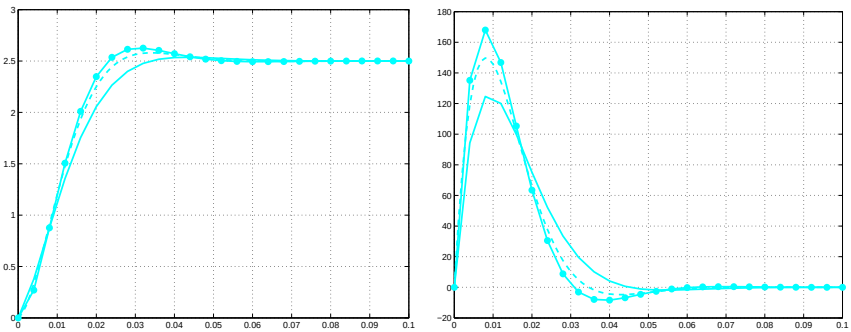
$$\lim_{n\to\infty} |z_n - u_n| = \frac{|\rho|}{|\lambda|}$$

pag. 215: The right picture of figure 7.13 is



and its caption is: "In this case the regions are unlimited and span outside the closed lines."
pag. 222, row 7: "with $h = 0.01$" should be "with $h = 0.001$"

pag. 222, row 17-18:
"and λ can be set equal to -141.4214. Then a condition for absolute stability is to take $h < 2/|\lambda| = 0.0282$."
should be
"and $\lambda_{1,2} = -100 \pm 100i$. Then the condition for absolute stability is to take $h < -2Re(\lambda_i)/|\lambda_i|^2 = 0.01$."
pag. 222: Fig. 7.16 should be



pag. 223, row -19: "$\zeta > (\theta + 1/2)^{2/4}$" should be "$\zeta > (\theta + 1/2)^2/4$"
pag. 224, row -3: "$h = 0.04$" should be "$h = 0.004$"
pag. 225, row 10: "equal to $2\mathbf{x}^T$" should be "equal to $2\mathbf{x}$"
pag. 226, row -4: "only 2000 steps" should be "only 1000 steps"
pag. 226, row -2: "$r = 0.0966$" should be "$r = 0.0928$"
pag. 229, row : formula (7.63) and (7.64) should be, respectively:

$$\frac{d^2\mathbf{x}_e}{dt^2} = 4\pi^2 \left(\frac{M_m}{M_s} \frac{\mathbf{x}_m - \mathbf{x}_e}{|\mathbf{x}_m - \mathbf{x}_e|^3} - \frac{\mathbf{x}_e}{|\mathbf{x}_e|^3} \right).$$

$$\frac{d^2\mathbf{x}_m}{dt^2} = 4\pi^2 \left(\frac{M_e}{M_s} \frac{\mathbf{x}_e - \mathbf{x}_m}{|\mathbf{x}_e - \mathbf{x}_m|^3} - \frac{\mathbf{x}_m}{|\mathbf{x}_m|^3} \right).$$

pag. 230, row 11: "with a tolerance of 1e-6" should be "with a tolerance of 1e-3"
pag. 244, row -7: "$\varphi_0(x) = (a + h - x)/h$" should be "$\varphi_0(x) = (x_1 - x)/(x_1 - a)$"
pag. 244, row -6: "$\varphi_{N+1}(x) = (x - b + h)/h$" should be "$\varphi_{N+1}(x) = (x - x_N)/(b - x_N)$"
pag. 244-245: the last formula of pag. 244 and the first two formulas of pag. 245:
"we find that for all $j = 1, \ldots, N$

$$u_{j-1}\int\limits_{I_{j-1}}\varphi'_{j-1}(x)\varphi'_j(x)\ dx+u_j\int\limits_{I_{j-1}\cup I_j}\varphi'_j(x)\varphi'_j(x)\ dx$$
$$+u_{j+1}\int\limits_{I_j}\varphi'_{j+1}(x)\varphi'_j(x)\ dx=\int\limits_{I_{j-1}\cup I_j}f(x)\varphi_j(x)\ dx+B_{1,j}+B_{N,j},$$

where

$$B_{1,j}=\begin{cases}-\alpha\int\limits_{I_0}\varphi'_0(x)\varphi'_1(x)\ dx=-\dfrac{\alpha}{x_1-a} & \text{if } j=1,\\ 0 \text{ otherwise,}\end{cases}$$

while

$$B_{N,j}=\begin{cases}-\beta\int\limits_{I_N}\varphi'_{N+1}(x)\varphi'_j(x)\ dx=-\dfrac{\beta}{b-x_N} & \text{if } j=N,\\ 0 \text{ otherwise".}\end{cases}$$

should be
"we find that

$$u_1\int\limits_{I_0\cup I_1}\varphi'_1(x)\varphi'_1(x)\ dx+u_2\int\limits_{I_1}\varphi'_2(x)\varphi'_1(x)\ dx$$
$$=\int\limits_{I_0\cup I_1}f(x)\varphi_1(x)\ dx+\frac{\alpha}{x_1-a},$$
$$u_{j-1}\int\limits_{I_{j-1}}\varphi'_{j-1}(x)\varphi'_j(x)\ dx+u_j\int\limits_{I_{j-1}\cup I_j}\varphi'_j(x)\varphi'_j(x)\ dx$$
$$+u_{j+1}\int\limits_{I_j}\varphi'_{j+1}(x)\varphi'_j(x)\ dx=\int\limits_{I_{j-1}\cup I_j}f(x)\varphi_j(x)\ dx,\quad j=2,\dots,N-1,$$
$$u_{N-1}\int\limits_{I_{N-1}}\varphi'_{N-1}(x)\varphi'_N(x)\ dx+u_N\int\limits_{I_{N-1}\cup I_N}\varphi'_N(x)\varphi'_N(x)\ dx$$
$$=\int\limits_{I_{N-1}\cup I_N}f(x)\varphi_j(x)\ dx+\frac{\beta}{b-x_N}."$$

pag. 245, row 8-9:
"Consequently, we obtain for $j=1,\dots,N$

$$-u_{j-1}+2u_j-u_{j+1}=h\int\limits_{I_{j-1}\cup I_j}f(x)\varphi_j(x)\ dx+B_{1,j}+B_{N,j}."$$

should be
"Consequently, we obtain

$$\begin{aligned}
2u_1 - u_2 &= h \int_{I_0 \cup I_1} f(x)\varphi_1(x)\ dx + \frac{\alpha}{x_1 - a}, \\
-u_{j-1} + 2u_j - u_{j+1} &= h \int_{I_{j-1} \cup I_j} f(x)\varphi_j(x)\ dx, \qquad j = 2, \ldots, N-1, \\
-u_{N-1} + 2u_N &= h \int_{I_{N-1} \cup I_N} f(x)\varphi_N(x)\ dx + \frac{\beta}{b - x_N}."
\end{aligned}$$

pag. 247, row -1: "from the top to the bottom" should be "from the bottom to the top"
pag. 248, row -4,-3: "Consequently, (8.26) becomes

$$(\mathbf{v}_1^T \mathrm{K} \mathbf{v}_1 + \mathbf{v}_2^T \mathrm{K} \mathbf{v}_2 + \ldots + \mathbf{v}_{N_y}^T \mathrm{K} \mathbf{v}_{N_y})/h_x^2$$

should be
"Consequently, (8.26) becomes

$$\begin{aligned}
\mathbf{v}^T A \mathbf{v} = &\frac{1}{h_x^2} \sum_{k=1}^{N_y - 1} \mathbf{v}_k^T K \mathbf{v}_k \\
&+ \frac{1}{h_y^2} \left(\mathbf{v}_1^T \mathbf{v}_1 + \mathbf{v}_{N_y}^T \mathbf{v}_{N_y} + \sum_{k=1}^{N_y - 1} (\mathbf{v}_k - \mathbf{v}_{k+1})^T (\mathbf{v}_k - \mathbf{v}_{k+1}) \right)
\end{aligned}$$

pag. 249, row 16: "$\Omega = (a, c) \times (b, d)$" should be "$\Omega = (a, b) \times (c, d)$". Note that program poissonfd.m changes in the same way. The correct version of the file `poissonfd.m` is posted on `mox.polimi.it/qs` inside the updated file `Programs.tar.gz`
pag. 253, row -2: "$j = 1, \ldots, N-1$" should be "$j = 1, \ldots, N$"
pag. 253, row -8: "$u(x, 0) = u_0(t)$" should be "$u(x, 0) = u^0(t)$"
pag. 253, row -1: "$u_0(t) = u_N(t) = 0$" should be "$u_0(t) = u_{N+1}(t) = 0$"
pag. 254, row 2: "$u_j(0) = u_0(x_j), \qquad j = 0, \ldots, N$" should be "$u_j(0) = u^0(x_j), \qquad j = 0, \ldots, N+1$"
pag. 254, row 6: "$\mathbf{u}(0) = \mathbf{u}_0$" should be "$\mathbf{u}(0) = \mathbf{u}^0$"
pag. 254, row 7: "$\mathbf{u}(t) = (u_1(t), \ldots, u_{N-1}(t))^T$" should be "$\mathbf{u}(t) = (u_1(t), \ldots, u_N(t))^T$"
pag. 254, row 8: "$\mathbf{f}(t) = (f_1(t), \ldots, f_{N-1}(t))^T$" should be "$\mathbf{f}(t) =$

$(f_1(t), \ldots, f_N(t))^T$"

pag. 254, row 8: "$\mathbf{u}_0(t) = (u_0(x_1), \ldots, u_0(x_{N-1}))^T$" should be "$\mathbf{u}^0(t) = (u^0(x_1), \ldots, u^0(x_N))^T$"

pag. 254, row 10: "$u_0(x_0) = u_0(x_N) = 0$" should be "$u^0(x_0) = u^0(x_{N+1}) = 0$"

pag. 254, row 17: "$\mathbf{u}^0 = \mathbf{u}_0$" should be "$\mathbf{u}^0$ given"

pag. 254, row -13: "I is the identity matrix of order $N-1$" should be "I is the identity matrix of order N"

pag. 255, row 5: "$\lambda_j = 2 - 2\cos(j\pi/N)$, $j = 1, \ldots, N-1$" should be "$\lambda_j = 2 - 2\cos(j\pi/(N+1))$, $j = 1, \ldots, N$"

pag. 255, row -14: "on the square domain $\Omega = (a,b) \times (c,d)$" should be "on the domain $\Omega = (a,b)$"

pag. 255, row -13: "the vector `xspan=[a,b]`, `yspan=[c,d]` should be "the vector `xspan=[a,b]`"

pag. 255, row -10: "$f(t, x_1(t), x_2(t))$" should be "$f(t, x(t))$"

pag. 255, row -9: "$u_0(x_1, x_2)$" should be "$u^0(x)$"

pag. 264, row 3: "A$\in \mathbb{R}^{(N-1)\times(N-1)}$" should be "A$\in \mathbb{R}^{N\times N}$"

pag. 264, row 5: "$\lambda_j = 2(1-\cos(j\theta)), \quad j = 1, \ldots, N-1,$" should be "$\lambda_j = 2(1-\cos(j\theta)), \quad j = 1, \ldots, N,$"

pag. 264, row 7: " $\mathbf{q}_j = (\sin(j\theta), \sin(2j\theta), \ldots, \sin((N-1)j\theta))^T$, " sould be "$\mathbf{q}_j = (\sin(j\theta), \sin(2j\theta), \ldots, \sin(Nj\theta))^T$,"

pag. 264, row 8: "$\theta = \pi/N$" should be "$\theta = \pi/(N+1)$"

pag. 265, row 9: "conductivity is $k = 0.2$ cal/sec·cm·C." should be "conductivity is $k = 0.2$ cal/(sec·cm·C)."

pag. 265, row 10: "Denote by $Q = 5$ cal/cm^3·sec" should be "Denote by $Q = 5$ cal/(cm^3·sec)"

pag. 277, row 21: "`price2002`" should be "`price2001`"

pag. 277, row 22: "November 2002" should be "November 2001"

pag. 281, row 15: "$c.\ \frac{1}{30} f^{(4)}(\xi_3) h^4$." should be "$c.\ \frac{1}{6} f^{(4)}(\xi_3) h^3$."

pag. 281, row -3: "this number is 51" should be "this number is 71"

pag. 283, row 2:

$$f_1^{(4)}(x) = \frac{24}{(1+(x-\pi)^2)^5(2x-2\pi)^4} - \frac{72}{(1+(x-\pi)^2)^4(2x-2\pi)^2} + \frac{24}{(1+(x-\pi)^2)^3},$$

should be $f_1^{(4)}(x) = 24\dfrac{1-10(x-\pi)^2+5(x-\pi)^4}{(1+(x-\pi)^2)^5}$,

pag. 283, row 5:"$M_1 \simeq 25$" should be "$M_1 \simeq 23$"

pag. 283, row 6: "$M_2 \simeq 93$" should be "$M_2 \simeq 18$"
pag. 283, row 21: "with $H < 0.25$" should be " with $H < 0.0625$"
pag. 284, row -3, -2: "it is actually a polynomial of degree 3" should be "it is actually a polynomial of degree 2"
pag. 301, row 2: "`phi=0`" should be "`phi=pi/180`"

Some Matlab programs have been corrected. They are posted on the page `http://mox.polimi.it/qs` inside the updated files `Programs.tar.gz` and `Programs.zip`.