WS 2002/2003 October 21, 2002
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`http://www.math.uni-goettingen.de/schulz/`

1. Exercise in Mathematics and Scientific Computing for Inverse Problems

(Matlab Tutorial)

1. Problem (2 points)

On the unix-system in the NAM, *Matlab* is available in different versions. It can be started by entering `> matlab &` at the prompt. The largest window gives you textual access to the *Interpreter*, i.e. you may execute commands. With `help [<function>]` you can access extensive help of the available functions. Matlab is not a conventional programming language, but it is a higher programming-system on the same level as specialized expert systems, in difference to classic high programming languages. You can find a valuable tutorial for Matlab in the integrated help-browser. Get familiar with the basic functions and functioning of Matlab.

2. Problem (2 points)

Take a look at the graphical capabilities of Matlab, in particular `plot`,`surf` and `contour`. Construct a matrix which represents values per position and visualize this with `surf`. Example: Construct graphics of $f(x, y) = \sin(x) \cdot \cos(y)$ and plot density and contourgraphics.

3. Problem (4 points)

Write a matlab function which constructs a triangulation of a circle in $\mathbb{R}^2$. The corresponding triangles should be regular in the sense that all the angles should be greater than $\pi/5$. A triangle is described through the coordinates of the corners. Save the triangulation in a matrix, so that every line consists of the coordinates of the corners in the form

$$x_1 \;\; y_1 \;\; x_2 \;\; y_2 \;\; x_3 \;\; y_3$$

Write another function which shows the triangle-grid.

4. Problem (4 points)

Consider continuous functions on $I := [0, 1]$, i.e. the space $C(I)$. Then with given continuous kernel $k : I \times I \to \mathbb{R}$ and given function $\varphi \in C(I)$ (both available as Matlab functions), develop a program which numerically calculates the integral operator

$$(A\varphi)(x) = \int_I k(x, y)\varphi(y)\,\mathrm{d}\,y \quad x \in I$$

Use either rectangular or trapezoidal rule.

Sum of Points: 12

Questionaire 1

Mathematics and Scientific Computing for Inverse Problems

1. What semester are you in?
   ....

2. What field of mathematics (or your mayor field of study) do you specialise in ?
   ....
   ....

3. Whats your minor field of study?
   ....

4. Did you already begin to write a diploma thesis or want to begin shortly ? If so, who is your advisor?
   ....

5. Which of the following lectures did you attend already?
   (a) ☐ Numerical mathematics I
   (b) ☐ Numerical mathematics II
   (c) ☐ Functional analysis
   (d) ☐ Partiel differential equations
   (e) ☐ Numerical treatment of partiel differential equations
   (f) ☐ Integral equations
   (g) ☐ other relevant lectures ....

6. What programming languages/systems do you have experience in?
   (a) ☐ Fortran
   (b) ☐ Pascal
   (c) ☐ VisualBasic
   (d) ☐ C/C++

   (e) ☐ Mathematica
   (f) ☐ Maple

(g) ☐ Matlab

Describe other experiences with programming:
....
....

7. Why do you attend this lecture ?

   (a) ☐ To make your exam in applied mathematics
   (b) ☐ To write a diploma- or master-thesis in this field
   (c) ☐ Because specific problems in this field are fascinating
   (d) ☐ General interest
   (e) ☐ ....

8. Do you have special demands/wishes on the content of the lecture? Describe:
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....

9. Do you have special demands/wishes for the practical exercises, in particular to the parts of the numeric or scientific computing? Describe:
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10. Formulate your personal goal for this lecture:
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