Possible Topics for a Presentation

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1 Here are some possible projects for *Octave*

1.1 BYO

Bring Your Own !

1.2 Animation of Robot by Patric Eichelberger

In the BME lab (fifth floor) Patric Eichelberger built a robot to "shake patients". Write *Octave* code to animate this robot, using the exact formulation and the linear approximation. See the file `Eichelberger.pdf` on the web page or my lecture notes on Linear Algebra

1.3 Audio

- Use the packages on `http://folk.uio.no/fl/aaudio.shtml` to record sound signal, then do some signal processing, spectrum analysis, . . .

- There is a second sound package available at `http://www.playrec.co.uk/` .

- With a bit of external electronics the audio card of a PC can be turned into an AD converter, thus you can build a digital oscilloscope.

1.4 Signal Processing

Use your knowledge of signal processing and solve example problems with *Octave*. The signals might be collected by the sound card.

1.5 Filter Design Toolbox

Octave has very powerful commands for filter design, but `MATLAB` has a very nice GUI and graphics to visualize the effects of the filters. Write a good visualization tool, using the filter commands of *Octave*. Compare to the `MATLAB` version created by `fdatool` .

- Calling your `fdatool.m` can create the graph of the designed filter, with the desired parameters, for verification.

1.6 Image Processing

- Simple image processing with the OctaveForge toolbox

- Examples, examples, examples,... e.g. edge detection, smoothing, ...

- Compare different algorithms provided.

1.7 Statistics with *Octave*

Octave has many built in commands for statistical applications. Use your knowledge in statistics and probability to set up and solve problems with *Octave*. Have a look at the section `Statistics` in the *Octave* manual.

- Built in PDF

- Testing of hypothesis, Anova test

- Quality control

- Examples, examples, examples, with documentation

1.8 Control Theory, block diagrams, transfer functions with *Octave*

There is an *Octave* package for control problems: `control`

- Examples, examples, examples

- Redo your homework with the help of *Octave*

- Documentation

1.9 Professor SVD: Gene Golub

Search on the internet for the above keywords and find an article about Gene Golub and SVD (Singular Value Decoposition). Apply SVD to image processing, resp. compression.

1.10 Linear Programming

- What is LP?

- Examples

- How to use the built in *Octave* commands.

1.11 Packages BIM and MSH

For octave there are 2 packages BIM and MSH (mesh) useful to solve advection diffusion problems in 1, 2 and 3 space dimensions. Het conduction problems are of this type.

- Install and test the packages.

- Learn how to generate triangular meshes.

- Solve and document a few examples.

  Find documentation at

- `http://octave.sourceforge.net/packages.php`

- `http://wiki.octave.org/Bim_package`

1.12 Flow Lines for Gradient Field

Given data of a scalar function, either scattered or on a rectangular grid.

- compute and display the vector field generated by the gradient

- compute and display flow lines. On might use `gradient` and `quiver` and solve the corresponding differential equations.

1.13   Solar System Simulator

- Consider

  - Earth and moon
  - Earth, moon and a satelite
  - Sun, earth and moon
  - Sun and some planets

- Aim for **reliable** results, quickly computed. Use .oct files and C code.

- Amimation

1.14   Finite Difference Methods

The method of **F**inite **D**ifferences can be used to model different effects.

- steady state heat conduction

- dynamic heat conduction

- vibrating string

- vibrating membrane

1.15   Financial Planner

Save money at a fixed rate or consume money at a fixed rate. Examine saved amount.

- Discrete, different time intervals

- As ODE

- Compare

- Documentation

1.16   Correlation, Correlation, Eigenvalues and PCA

Data analysis with multiple parameters. Symmetric matrices, diagonalization, covariance, Principal Component Analysis.

- Generate a readable example with documentation