Comparison of the main features of SCILAB, OCTAVE and MATLAB for some optimization and control problems

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Abstract
The main goal of this project is the comparison between MATLAB, SCILAB and OCTAVE in the solution of some problems in the area of linear systems response simulations, linear systems feedback control and function minimization (unconstrained and constrained problems). Both open source software (SCILAB and OCTAVE) showed comparable results and user interface to MATLAB for the minimization problems. For the control problems, the open software do not have some specific functions, but they allow solving the equivalent problems with some extra code implementation.

System-optimization, Mechanical-system control, MATLAB, SCILAB, OCTAVE

Introduction
Some problems were selected to compare MATLAB, SCILAB and OCTAVE in the solution of some optimization problems, feedback control and H-infinity control problems. The results were compared in terms of the obtained solution and in terms of the computational time when applicable. Some results and conclusions are presented in the following.

Results and Discussion
In the scope of systems optimization, both open source software (OCTAVE and SCILAB) provided good results compared to MATLAB. For the unconstrained examples, SCILAB was about ten times slower than MATLAB and OCTAVE, which took the same time. For constrained optimization, the three software took approximately the same time to solve the selected problems. The same stop criteria were used for this comparison, with the same initial point. The provided solutions were the same for all software.

OCTAVE, SCILAB and MATLAB solved the feedback control of linear systems problem satisfactorily. However, for a H-infinity problem, both open source software did not solve the tested problem that was solved with MATLAB. Functions as bode diagram, singular values and norm calculation worked well in the three software. Functions to find damping ratio are not present on OCTAVE and functions to compute H-infinity optimal controller did not work on both open source software for the tested problem. This requires further investigation to understand the reasons, since the same problem was solved in MATLAB.

One important difference between SCILAB and OCTAVE, when compared with MATLAB, is the programming interface. OCTAVE accepts files with the extension ".m", the same as MATLAB. However, SCILAB has its own language codification, and it is required some changes to run the same problem in this software.

Conclusions
This project showed the potential of OCTAVE and SCILAB open source software to solve some problem in the fields of optimization and control. SCILAB and OCTAVE can be used for the solution of these categories of problems with some extra code implementation. OCTAVE, however, has an advantage over SCILAB because of its programming language which is very close to MATLAB.

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1 http://www.mathworks.com/help/matlab/
2 http://help.scilab.org/docs/5.5.2/en_US/index.html
3 https://www.gnu.org/software/octave/doc/interpreter/