# MAPLE from the point of view of non-native speakers – students of technology

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**Abstract**

This contribution deals with the issue of language barrier in teaching mathematics. We look at MAPLE – a software product not communicating in Czech – from the point of view of a Czech speaker, a first year student of technology with no knowledge of mathematical terminology in English and no previous experience with MAPLE. The contribution is a sequel to a similar article on MATLAB.

## 1 Introduction

The main part of mathematical subjects at technical universities is often concentrated in the first two or three terms of bachelor degree. Computer classes are usually included in order to enhance teaching and learning, to make them more effective and more attractive for students. However, this leads to an interesting paradox: *how can learning be more effective when a tool (a software product in this respect) the language of which students are not (and cannot be) familiar with is used?* MAPLE, MATLAB or MATHEMATICA all communicate in English, yet a first year student is obviously familiar with general English only. Is he/she capable of using the above mentioned software products effectively, then?

In [3] we set three simple tasks and tried to model and follow a typical students' strategies in solving them using MATLAB. When doing this, we tried to place ourselves in the position of a target student, i.e. we pretended not to know MATLAB and we adjusted our English accordingly. This article is a sequel to [3] – it uses the same tasks, the same strategies and has the same format.

## 2 Maple help

References made throughout the contribution are valid for MAPLE 9.5 Classic Worksheet, release date April 2004. The factual part of the new interface (now known as MAPLE 9.5) and types of help listed in the following paragraph are the same. The visual part, however, is different. We refer to the Classic Worksheet because of its similarity to previous MAPLE versions and numerous comments on its greater user-friendliness.

### 2.1 Types of Maple help

MAPLE help resources fall into four groups:

- main body of standard help (accessible via `Help → Topic Search` or `Full Text Search...` commands or as context sensitive help) with `Help Browser` for easier navigation

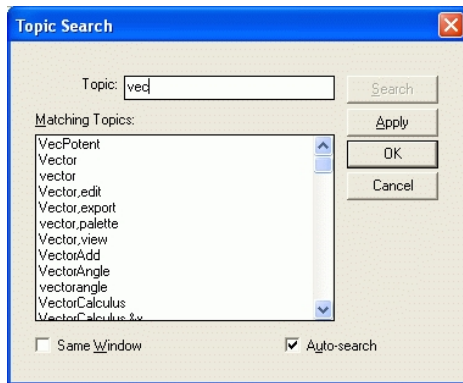- supplementary help items (balloon help, `Using help` entry, etc.)

Figure 1: MAPLE Topic Search

- example worksheets accessible via the top level entry `Example Worksheet Index` of the `Help Browser`

- `Maple on the Web` (`http://www.maplesoft.com/support/index.aspx`) and other resources including printed materials

As we are trying to model standard classroom situations in the contribution, we are going to leave out the last option. As supplementary help items are not of great importance in this respect, we are going to concentrate on using standard help only.

### 2.1.1 Topic search

The topic search is accessible via `Help → Topic Search...` menu item. The user gets a pop up window where a word or phrase to look for can be entered. The list of relevant items can become a dynamic one, i.e. it can change as the user enters additional characters, by checking the `Auto-search` button. The user than selects an entry and jumps to the respective topic.

### 2.1.2 Full text search

Full text search is accessible via `Help → Full Text Search...` menu item. The usage is the same as for the topic search. The list is not dynamic, however. Goodness of match can be displayed for individual entries.

### 2.1.3 Help browser

MAPLE uses a specialised `Help Browser` in order to enable easy help navigation. Once a topic is selected a list of its subtopics is displayed. This keeps repeating till the user gets the desired topic. The `Help Browser` window is displayed in the top frame of the worksheet whereas the bottom frame displays the actual topics.

### 2.1.4 Context sensitive help

When a user leaves cursor on a word and presses `CTRL+F1` (in a worksheet), Context sensitive help is activated and the most relevant help entry with the same name or a list of relevant matches is displayed.
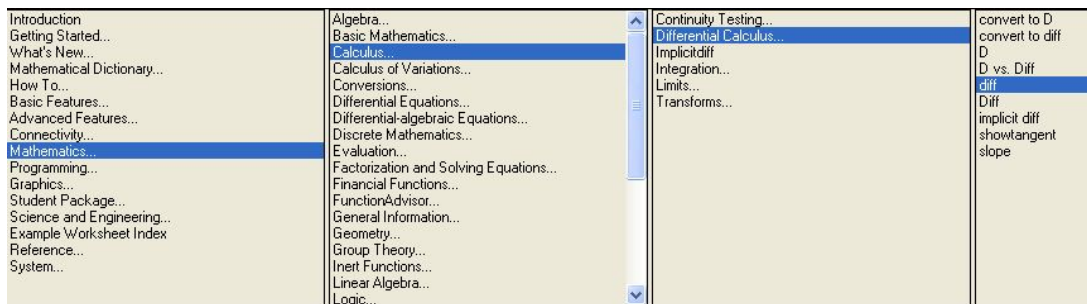
Figure 2: MAPLE Help Browser

### 2.1.5  Mathematical Dictionary

MAPLE contains its own `Mathematical Dictionary` accessible as a top level entry in the `Help Browser`. However, it contains definitions only (i.e. no translations or examples). Moreover, the definitions naturally use mathematical terminology. The dictionary is ordered alphabetically and does not support any kind of filtering (e.g. according to fields of mathematics, level of user). As a result, its use for non-native speakers of English is very limited.

## 3  Sample tasks to be solved by a new user

MAPLE and MATLAB are being used at many universities and technical universities. Since they are not available in Czech, English versions have to be used. At technical universities students usually encounter the software products in the first and / or second year. At that stage their knowledge of English ranges from false beginner to intermediate yet their knowledge of mathematical or scientific terminology is very limited (if any) regardless of their level. For more details see [2], which discusses the FEEC BUT context. Therefore, let us now follow a typical student's encounter with MAPLE. We presume that the students has not used MAPLE before (if yes, they know only basic rules of syntax). We are going to face the following tasks:

- count an inverse of a matrix,

- solve a system of linear equations and,

- find a value of derivative of a function at a given point.

All of these are basic tasks that all students of technology face at a very early stage of their studies.

In order to solve the outlined tasks we are going to use help tools supplied by MAPLE itself – online resources or printed books are not going to be used. Efficiency and straightforwardness will be our highest priority.

## 4  The tasks solved

### 4.1  Inverse of a matrix

**Task:** *Enter a matrix and write a command to count its inverse.*

Entering `matrix` and calling Context sensitive help with `CTRL+F1` leads the user to the `Matrices` help entry. Even though the text is not easy to read for a member of the target group, orientation in it is sufficiently easy. Moreover, the very first example in the clearly marked `Example` section

gives full syntax of entering a matrix. Maple is therefore far more user-friendly than Matlab in this respect (cf. [3]).

Navigation to the `Matrices` entry using Help Browser is almost impossible, though, as the correct path is: `Mathematics → Superseded packages → linalg package → Data structures`. The more convenient `Linear Algebra Overview` entry under `Mathematics → Linear Algebra` gives three links in its `Matrix and Vector Entry Operations` section: `Assignment`, `Selection`, `Extraction`. The `Assignment` link is a direct and very useful one – as it is the first one, students are likely to follow it even if they do not the actual meaning of the word.

Entering `matrix` in the Topic search window directly leads the user to the same entry as using the Context sensitive help. Entering the same string in the Full text search window, however, is less likely to help – a long and almost useless (for a member of the target group) list is displayed. Even though it includes a `Matrix` entry, which leads to a lengthy text most likely not to be read by a member of the target group (in spite of the fact that some useful examples are included there), its goodness of match is given as (0.00).

Finding the inverse of a matrix can be straightforward as well. The `See also` section of the `Matrices` entry includes `linalg` and `linalg[matrix]` links (the latter includes the `\linalg` link in its own `See also` section). The `linalg` entry lists all commands of the `linalg` package, which includes the desired `inverse` command. The respective help entry is a simple and easy to follow one.

Entering `inverse` into the Topic search window results in two most likely relevant matches `Inverse` (the correct one) and `inverse` (which is not relevant, though). The Full text search is of less help – it gives a long list of matches. However, `linalg[inverse]` is included – yet it is not prominent and its goodness of match is (0.00) again, though.

## 4.2   A system of linear equations

**Task:** *Enter a system of linear equations and solve it.*

The obvious choices for the Context sensitive help are `linear` and `equation`. In a sharp contrast to Matlab (cf. [3]) both of these lead to meaningful and helful help entries (another obvious option – `system` – gives a misleading result, though). `linear` informs the user that there is a choice of matches: `type,linear`, which the user is more likely to open yet then close immediately, and `solve,linear` the heading of which reads `solve,linear - systems of linear equations`, which is exactly what the student is looking for. The entry is reasonably short and the clearly marked `Examples` section starts with a self-explanatory example of solving a system of two equations. The `See also section` suggests `linalg[linsolve]` and `solve[system]` which both lead to entries likely to be understood by students from the target group. Even though the texts themselves are not easy to understand, the examples are. Thus the student is presented with a choice of strategies for solving the task in a reasonably short time.

The `equation` keyword is not so straightforward, though. It leads to a general entry on equations, inequalities and inequality signs. Although rewarding, they are not steps on the correct answer path.

Given the nature of Maple help files, entering `linear` or `equation` gives the same results as Context sensitive help. The Full text search is of as little use as with the inverse of a matrix.

The Help browser stores the `type,linear` entry on its fifth level, the top level entry being `Programming`, which is obviously to be missed by target group students. The most useful entry, `linalg[linsolve]` is stored under `Mathematics → Factorisation and Solving Equations`. However, it is questionable if students are likely to identify the `linsolve` entry as a correct one. `solve` is another option at this level. Anyway – the knowledge of the meaning of *solve* is essential in this respect.

### 4.3 Derivatives

**Task:** *Find a value of derivative of a function at a given point.*

The obvious keyword for this task is `derivative`. As follows from [3], using this in `Matlab` command window is of no use. In MAPLE, however, entering `derivative` (or the `der` string at least) results in a list of links headed by `derivative`, which is linked to the
`diff or Diff - Differentiation or Partial Differentiation` help entry. The comprehensible text is once again followed by illustrative examples headed by `diff(sin(x),x);` and its output. This helps immensely as even if the student cannot comprehend the text, the $(\sin x)' = \cos x$ is a notorious example.

Given the nature of MAPLE help, the Topic search and Full text search options lead to the same results.

The user can navigate to the above mentioned `diff` entry via `Mathematics → Calculus → Differential Calculus`. As with the previous tasks, this requires some knowledge of mathematical terminology in English. However, browsing the top and second level entries leads to the `Differential Calculus` heading almost inevitably.

Thus the user knows how to find a derivative of a function. Finding its value is a task where MAPLE help may not be needed at all. If it is, entering `substitute` or its initial letters into either Context sensitive help or Topic search quickly solves the issue.

## 5 Conclusion

As far as the nature and user-friendliness of help files is concerned, MAPLE seems to be a better option than MATLAB, which is an obvious result of comparing this contribution and [3]. A number of "but" suggestions may arise in this respect, though – most notably concerning our choice of tasks.

Yet making a comparison of MAPLE and MATLAB was not the intention of our effort. We wanted to show that MAPLE and MATLAB users – bachelor students of technology – face the same problems instead. Help files navigation is difficult in both of the products, or rather difficult in MAPLE and almost impossible in MATLAB without at least basic knowledge of mathematical terminology in English. Once students have knowledge of even a handful of basic words, their performance can improve dramatically. This can in turn improve the efficiency of both teaching and learning of mathematics. However, the context of language education at universities of technology makes this not always possible. For discussion on this topic concerning FEEC BUT, see [2].

## References

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