

## ENSL - ER03: Logic of Dynamical Systems Installing Mathematica and KeYmaera

KeYmaera is an automated theorem prover that you will use for every lab assignment in this course. Mathematica is also used as a powerful backend arithmetic solver. We provide instructions on installing Mathematica and running KeYmaera from your own computer. To save time in the course, please have KeYmaera and Mathematica running on your computers **before the course begins**.

We have also uploaded a video in our youtube tutorial series that walks through the KeYmaera installation process: <http://youtu.be/mA2ttUfMo7Q>

### 1. Setup KeYmaera and Mathematica

**Option 1:** Run KeYmaera on Mac with Mathematica installed.

Download and then open the file found here:

<http://www.ls.cs.cmu.edu/KeYmaera/keymaera-installer.jar>

Alternatively, you may open the file via the terminal with this command:

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$ java -jar keymaera-installer.jar
```

Skip to step 2.

**Option 2:** Install Mathematica and KeYmaera from any computer.

First, install Mathematica. A student version of Mathematica can be purchased or downloaded for a free 30 day trial here:

<http://www.wolfram.com/solutions/education/students/>

Next, download and open the KeYmaera installer file, which can be found here:

<http://www.ls.cs.cmu.edu/KeYmaera/keymaera-installer.jar>

2. Follow the installation directions. When installation is complete, click **Start KeYmaera** and KeYmaera will launch. You can always start and update KeYmaera from this dialogue box.
3. In KeYmaera's first dialogue box, check that the Mathematica path points to the location where Mathematica is installed. Change it to point to Mathematica if it doesn't already.

**Click OK.**

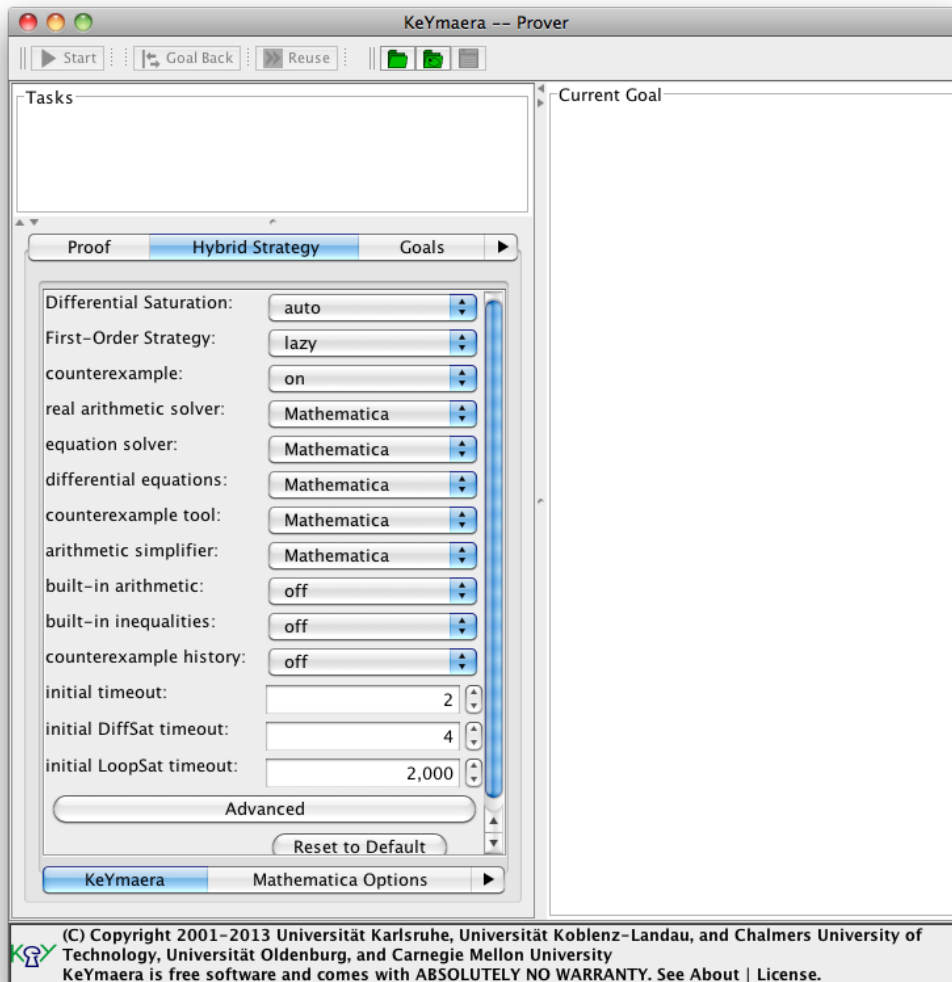


Figure 1: Mathematica should be selected as the solver for the five operations shown above.

4. You will likely get a **Configuration Warning** since you do not have all of the possible add-ons for KeYmaera already installed. If Mathematica, MathKernel, and JLink are not listed as missing, you are probably alright. **Click Yes**.
5. After successfully opening KeYmaera, click on the **Hybrid Strategy** tab, and confirm that Mathematica is the selected solver for the five operations shown in Figure 1.
6. **Prove a property** using KeYmaera and Mathematica.

Several examples and case studies are packaged with KeYmaera. Check that you can load and prove one of them by going to (File → Load Project), then from the ETCS Train Control, select ETCS Simple and click the Load button.

Click the start button. This theorem proves automatically, so after a few seconds, you will see a dialogue box that declares the property is proved and gives useful statistics, like the number of nodes and branches required. To view more statistics about your proof, like the computation time or memory usage, go to Proof → Show Proof Statistics.

Check that you can save your proof (File → Save), and then reload it by dragging and dropping the proof file into KeYmaera, or by selecting the file from (File → Load).

If you would like to see more proofs or explore more of KeYmaera’s functionality, go to File → Load Projects, to browse other projects and completed proofs.

## 7. Installation FAQ (Frequently Asked Questions)

The following is a list of common issues that students have had when installing KeYmaera. There is also a more comprehensive FAQ on using and installing KeYmaera, which can be found here: <http://symbolaris.com/info/KeYmaera-FAQ.html>

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### KeYmaera Installer Certificate (Step 2)

On a Mac, if you get this error about the digital signature when trying to open keymaera-installer.jar:



Go to System Preferences >> Security and Privacy. Under the General tab, Allow applications downloaded from: "Anywhere."

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### On Windows, KeYmaera Installer closes when I click "Start KeYmaera" (Step 2)

Most likely, the CLASSPATH that is being generated is wrong. Try to install KeYmaera to a path that does not contain any spaces. For this: Delete your .keymaera directory (probably located either in your home directory or maybe Documents folder).

Allow applications downloaded from:

- Mac App Store
- Mac App Store and identified developers
- Anywhere

Then just rerun the installer and select a directory that has no spaces in the path. It's a good idea to use C:\KeYmaera for testing purposes.

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**KeYmaera on 32bit Linux: must change J/Link path manually (Step 3)**

The installer/launcher nicely populates the MathKernel and the J/Link paths after entering the “Mathematica path”, but it defaults to ../Linux-x86-64 for the J/Link path, which is not right for a 32bit machine, where the path should be ../Linux.

With the wrong path, the symptom is cryptic: a waiting cursor and an unfinished task after loading the .key file, starting the proof completes several goals, but gets stuck at “1%” (no errors in the console). Changing the J/Link path manually fixes things.