Appendix E

User Manual for the Plugin SAGEMATH

• To use the SageMath plugin, the user must launch the Eclipse platform and then open the workspace containing our plugin project called "fr.upec.sageplugin" (see Figure E.1). This project contains various classes that we used to define the functionality provided by the plugin (see Figure E.2).

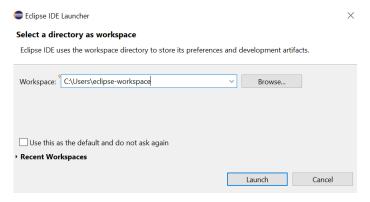


Figure E.1: Using plugin SAGEMATH: Step 1.

- Then the user should launch Rodin from within eclipse, using Rodin as the target platform. For this purpose, first open the "Run/Run configurations" menu (see Figure E.3) and double click on "Eclipse Application" on the left to create a new configuration and rename the configuration to "Rodin 3.5". On the "Main" tab, select "Location" for the run-time workspace and select "org.rodin.platform.product" for the "Run a product" option (see Figure E.4). In the "Plug-ins", for "Launch with" option, choose "plug-ins selected below only". In the Plugins list, disable all test plugins for the Target platform (see Figure E.5).
- The user can then run a version of Rodin with the SAGEMATH plugin integrated and upload the project containing the differential equations to be solved with SAGEMATH, remembering to open the project named "SimpleDEq" containing the theory needed to prove our EVENT-B models (see Figure E.6).
- The user can finally open the proof obligations that contains the terms $B_desolve$ in order to call SageMath. This is done by clicking in the goal tab on the left-hand side to get a button called SageMath (see Figure E.7).

```
eclipse-workspace - fr.upec.sageplugin/plugin.xml - Eclipse IDE
File Edit Navigate Search Project Run Window Help
Package E... Project Ex... □ □ ■ fr.upec.sageplugin □
                  ☐ $ ₹ $ 1k?xml version="1.0" encoding="UTF-8"?>
                                 2<?eclipse version="3.4"?>
  > ■ JRE System Library [JavaSE-11] 3 <plugin>
                                      <extension
  > Neg-in Dependencies
                                           point="org.eventb.ui.proofTactics">
                                        <tactic
    🗸 🕭 fr.upec.sageplugin
                                               icon="icons/sageimage.png"
      > 🔊 SageApplication.java
                                               id="SageMath'
                                               interrupt="true"
name="Sage"
priority="1"
      > 🛭 SageMathPlugin.java
                               10
      > 🔊 SageMathReasoner.java
      > 🛭 SageTactic.java
                                               skipPostTactic="false"
      > 🔊 SageTacticProvider.java
                               13
14
                                               tacticProvider="fr.upec.sageplugin.SageTacticProvider"
                                               target="goal
  > 💪 Car.zip_expanded
                                15
                                               tooltip="tooltip">
  > 🗁 icons
                                16
  > 📂 META-INF
                                17
                                     </extension>
  > 🔑 SageEntier
                                     <extension
                                           point="org.eventb.core.segprover.reasoners">
  > SageModelling
                                19
                                         <reasoner
  > 🔑 SageModels
                                             class="fr.upec.sageplugin.Reasoner1
                               21
  > 🔑 SageProject
                               22
23
                                               id="fr.upec.sageplugin.dblIneq"
name="Double Inequality">
  > STOP_Concrete
                               24
25
  > 🗁 test
                                        </reasoner>
                                     </extension>
  > 📂 test2
                               26
27
    build.properties
    🔑 plugin.xml
                                28</plugin>
```

Figure E.2: Using plugin SAGEMATH: Step 2.

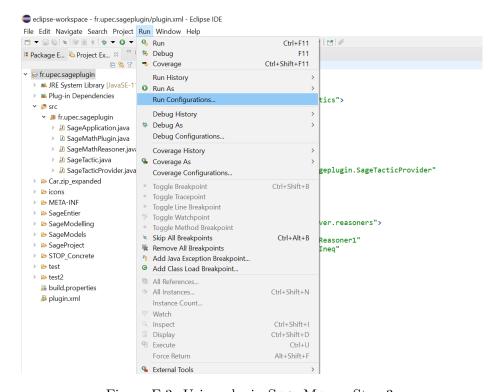


Figure E.3: Using plugin SAGEMATH: Step 3.

The user can eventually open the proof obligations containing the terms, $B_desolve$ or $B_desolve_rk4$, and then invoke SAGEMATH. To do this, click on the left side of the goal tab to get a button called SAGEMATH (see Figure E.7).

• Finally, the user calls SageMath and executes the command line load("script1.sage"). This allows the user to execute the statements defined in "script1.sage" script in order

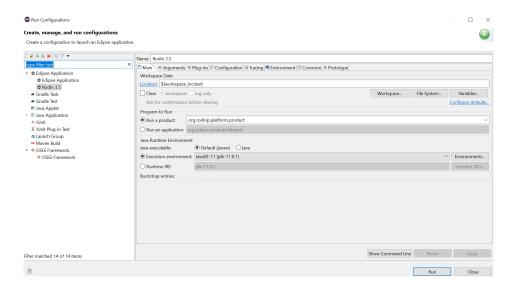


Figure E.4: Using plugin SAGEMATH: Step 4.

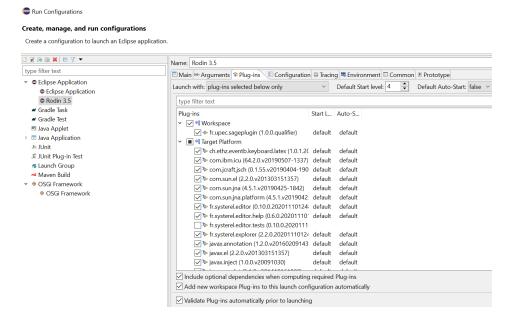


Figure E.5: Using plugin SAGEMATH: Step 5.

to solve the ordinary differential equation determined by the function $B_desolve$ in the current proof obligation (see Figure E.8).

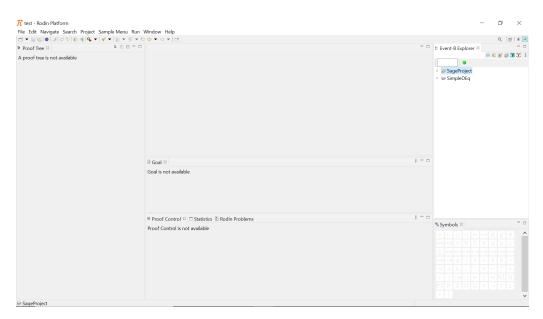


Figure E.6: Using plugin SAGEMATH: Step 6.



Figure E.7: Using plugin SAGEMATH: Step 7.

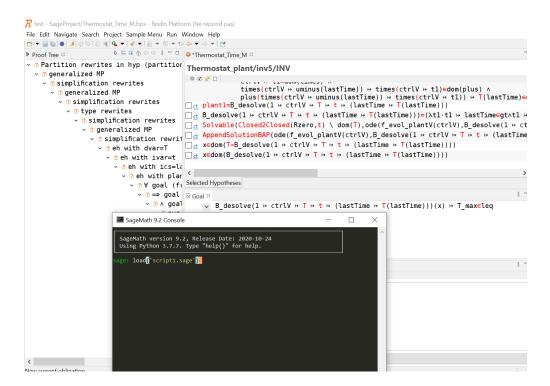


Figure E.8: Using plugin SAGEMATH: Step 8.