

Toolkit Release 2

Yiannis Andrianakis

July 8, 2009

- Public since 8/4/09
- Contains mostly the ThreadCoreGP
 - Priors
 - Design
 - Fitting
 - Uncertainty / Sensitivity analysis
- > 60 pages

Release 2

- 4 Threads
- > 90 pages
- New look!

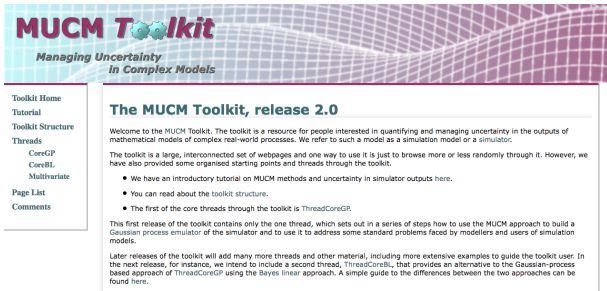
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MUCM Toolkit
*Managing Uncertainty
in Complex Models*

[Toolkit Home](#)
[Tutorial](#)
[Toolkit Structure](#)
[Threads](#)
 [CoreGP](#)
 [CoreBL](#)
 [Multivariate](#)
[Page List](#)
[Comments](#)

The MUCM Toolkit, release 2.0

Welcome to the MUCM Toolkit. The toolkit is a resource for people interested in quantifying and managing uncertainty in the outputs of mathematical models of complex real-world processes. We refer to such a model as a simulation model or a simulator.

The toolkit is a large, interconnected set of webpages and one way to use it is just to browse more or less randomly through it. However, we have also provided some organised starting points and threads through the toolkit.

- We have an introductory tutorial on MUCM methods and uncertainty in simulator outputs here.
- You can read about the toolkit structure.
- The first of the core threads through the toolkit is ThreadCoreGP.

This first release of the toolkit contains only the one thread, which sets out in a series of steps how to use the MUCM approach to build a Gaussian process emulator of the simulator and to use it to address some standard problems faced by modellers and users of simulation models.

Later releases of the toolkit will add many more threads and other material, including more extensive examples to guide the toolkit user. In the next release, for instance, we intend to include a second thread, ThreadCoreBL, that provides an alternative to the Gaussian-process based approach of ThreadCoreGP using the Bayes linear approach. A simple guide to the differences between the two approaches can be found here.

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New Threads

- ThreadCoreBL - *Jonathan*
- ThreadVariantMultipleOutputs - *Remi, Dan*
- ThreadGenericMultipleEmulators - *Tony*

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More varieties of Threads - Naming conventions

● Notation Page

Managing Uncertainty in Complex Models Jump Search

MUCMMUCMToolkit Edit WYSIWYG Attach Printable

You are here: [TWiki](#) > [MUCMMUCMToolkit Web](#) > [MetaNotation](#) #5 - 16 Jun 2009 - 23:48:05 - YiannisAndrianakis

Meta-pages: Notation

This page intends to gather (and possibly organise) the notation used in the MUCM toolkit.

Typographical conventions

- Unless otherwise stated, vectors are assumed to be column vectors
- \mathbb{R}^{d_l} , where d_l is a positive integer (or an expression evaluating to a positive integer, e.g. $p + 1$, $p[j]$), denotes the space of d_l -dimension, real-valued vectors
- $\mathbb{R}^{m \times p}$ denotes the space of real-valued matrices with m rows and p columns
- $\mathbb{R}^m \rightarrow \mathbb{R}^p$ denotes the space of functions (or mappings) from \mathbb{R}^m to \mathbb{R}^p

General notation

Symbol	Meaning	Domain	Link
$f(\cdot)$	Simulator	$\mathbb{R}^m \rightarrow \mathbb{R}^m$	
$E\{\cdot\}$	Expectation operator		DefGP
$cov\{\cdot, \cdot\}$	Covariance operator		DefGP
$vcc(\cdot)$	Vectorisation operator (column-wise)		
$\hat{x} = vcc(x)$			

ThreadCoreGP

Symbol	Meaning	Domain	Link
P	Number of (active) inputs		ThreadCoreGP

Navigation icons: back, forward, search, etc.

- Notation Page
- $E[x], \text{Var}[x, x'], \text{Cov}[x, x']$
- *A or R? $T(x)$ or $r(x)$?*
- *Are we using \mathbf{x} for vectors or x ?*
- *Do we keep the floating δ 's?*

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- Create personal sidebar

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Private access

-  MUCM Private
-  MUCM Admin
-  MUCM Toolkit
-  MUCM CS 1
-  MUCM CS 2
-  MUCM CS 3

Utilities

-  Index
-  Search
-  Changes
-  Notifications
-  Statistics
-  Preferences

[Edit](#) [WYSIWYG](#) [Attach](#) [Printable](#)

You are here: [TWiki](#) > [MUCM/MUCMToolkit Web](#) > [MetaToolkitReleases](#) > [MetaToolkitRelease2](#)

r11 - 07 Jul 2009 - 09:00:44 - TonyOHagan

Meta-pages: Toolkit Release 2

Progress

Pages

This is a complete list of the pages that will comprise the second release. Pages that have been modified since release 1 are marked *, while pages that are new in release 2 are marked **.

Generic pages

- [AltGPorBLEmulator](#)
- [MetaCopyrightNotice](#)
- [MetaSoftwareDisclaimer](#)
- [MetaToolkitPageList](#) *
- [MetaToolkitStructure](#) *
- [MetaToolkitTutorial](#)
- [MetaHomePage](#) *
- [MetaComments](#)

Definition/Glossary pages

- [DefActiveInput](#) **
- [DefBasisFunctions](#) **
- [DefBayesian](#)
- [DefBayesLinear](#)
- [DefBLAdjust](#) **
- [DefBLVarianceLearning](#) **
- [DefCalibration](#)
- [DefCofolInsights](#)

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🏠 MUCM home

Private access

🔒 MUCM Private

🔒 MUCM Admin

🔒 MUCM Toolkit

🔒 MUCM CS 1

🔒 MUCM CS 2

🔒 MUCM CS 3

Utilities

📄 Index

🔍 Search

📄 Changes

📄 Notifications

📄 Statistics

📄 Preferences

Edit WYSIWYG Attach Printable

You are here: TWiki > MUCM/MUCMToolkit Web > MetaToolkitStructure > ThreadCoreGP > ExamCoreGP1Dim

r5 - 08 Jul 2009 - 01:35:22 - YiannisAndrianakis

Example: A one dimensional emulator

Model (simulator) description

In this page we present an example of fitting an emulator to a $p = 1$ dimensional simulator (model), which is *surfebm*. The model has 11 inputs, but in this example we will keep all of them fixed, apart from 1, the solar constant. The model has three outputs, but in this example we are only interested in the mean surface temperature. Figure 1 shows the output of the model for the input range of the solar constant that we will try to emulate.

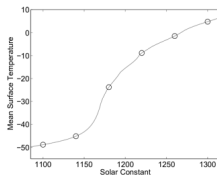


Figure 1. The output of the simulator and the selected design points.

Design

Design is the selection of the input points at which the simulator is to be run. There are several design options that can be used, as described in [AltCoreDesign](#). For this example, we will use an Optimised Latin Hypercube Design, which for one dimension is a set of equidistant points on the space of the input variable.

We select $n = 6$ design points, which are shown in Figure 1 as circles. These points are

$$\{\bar{x}_1, \bar{x}_2, \dots, \bar{x}_6\} = \{1100, 1140, 1180, 1220, 1260, 1300\}$$

Other (proposed) additions

- User Feedback
- Google analytics
- Internal blog
- Chart tool

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