

# Modelling, verification and experimentation for software-based systems (MOVEX)

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## Abstract

The repository contains course notes, exercises, models and projects from two courses given as part of master's level training on modelling and verifying software-based systems. It provides access to resources in the form of pdf files, TLA files, ACSL (C) files or Rodin files. Moreover, it aims to prepare students of the fourth year of University to apply modelling techniques for software-based systems. It is divided into two main parts:

- Part 1 **MALG1/MOVEX1** is shared by students in software engineering and in CPS engineering; the course is organised in 6 weeks (6 lectures x 2h00 ) (6 tutorials x 2 h 00). Topics are transition systems, invariance, safety, fixed-point theory, induction principles, Floyd/Hoare proof systems,
- Part 2 is divided into two distinct streams:
  - **MALG2** is the course is organised in 6 weeks (6 lectures x 2h00 ) (6 tutorials x 2 h 00)
  - **MOVEX2** the course is organised in 4 weeks (4 lectures x 2h00 ) (4 tutorials x 2 h 00)

The table of contents shows the summary of two main courses (at Université de Lorraine/University of Lorraine) based on our experiment using the modelling languages as TLA, Event-B and ACSL

- The first course **MALG** is part of the curriculum of the second year students of Telecom Nancy who are focusing on software engineering.
- The second course **MOVEX** is part of the curriculum of the second year students of Telecom Nancy who are focusing on embedded systems, as well as students of seconf year of ENSEM.

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## 1 Documentation and Tools

The TLA+ ToolBox platform is available at the following link.

The Rodin platform is available at the following link.

The Prob platform is available at the following link.

The Frama-c platform is available at the following link.

The Synchrone Reactive Toolbox for LUSTRE is available at the following link.

The Kind 2 platform is available at the following link.

## **2 Course MALG1/MOVEX1 at Telecom Nancy (in progress)**

### **2.1 Slides for the course MALG1/MOVEX1**

#### **2.1.1 Lecture 0 Overview of the course**

Overview of the course

#### **2.1.2 Lecture 1 Modélisation, spécification et vérification (I)**

- Modélisation, spécification et vérification (I)
- The MODULE cours0.tla modelling a simple abacus.
- The MODULE cours1.tla modelling a simple pre/post specification.
- The MODULE cours2.tla modelling the access control problem for a lecture theatre.

#### **2.1.3 Lecture 2 Modélisation, spécification et vérification (II)**

Modélisation, spécification et vérification (II)

#### **2.1.4 Lecture 3 Modélisation, spécification et vérification (III)**

Modélisation, spécification et vérification (III)

#### **2.1.5 Lecture 4 Vérification mécanisée de contrats (I)**

Vérification mécanisée de contrats (I)

#### **2.1.6 Lecture 5 Vérification mécanisée de contrats (II)**

Vérification mécanisée de contrats (II)

### **2.2 Lectures Notes**

Notes sur la logique Notes sur la logique.

Notes sur la vérification Notes sur la vérification.

Notes sur la preuve Notes sur la preuve.

### **2.3 Tutorials**

Notes on a tutorial using proofs Tutorial Notes for Proofs and Verifications Conditions of Contract.

Serie A Tutorials serie AA.

Tutorials serie AA with solutions (not yet January 26, 2026).

TLA solutions for serie AA .

Notes on a tutorial for verification conditions for the assert clause Tutorial Notes  
for verification conditions for the assert clause ..

## 2.4 Assessment

The assessment of students is based on three works:

- Two written exams: E1 and E2
- A practical exam: TP.
- E1 is shared by MALG1/MOVEX1.
- E2 is specific to MALG2 and MOVEX2.
- TP is specific to MALG2 and MOVEX2.

## 2.5 Past Exams

Les sujets des années passées sont contenus dans l'archive ANNALES.zip et des corrections sont données dans cette liste:

- Correction-malg-19mars2024

# 3 Course MALG2 at Telecom Nancy (past year)

## 3.1 Slides for the course MALG2

### 3.1.1 Lecture 0 Overview of the course

Overview of the course

### 3.1.2 Lecture 1 Vérification mécanisée de contrats (III)

Lecture 1 Vérification mécanisée de contrats (III)

### 3.1.3 Lecture 2 Théorie du point-fixe et applications

Lecture 2 Théorie du point-fixe et ses applications

### 3.1.4 Lecture 3 Sémantique ds langages de programmation

Lecture 3 Sémantique ds langages de programmation

### 3.1.5 Lecture 4 Interprétation Abstraite

Lecture 4 Interprétation Abstraite

## **3.2 Tutorials**

Serie A (MALG 2) Tutorials MALG 2 serie A.

Tutorials MALG 2 serie A with corrections.

Serie B (MALG 2) Tutorials MALG 2 serie B.

Tutorials MALG 2 serie B with corrections.

Serie C (MALG 2) Tutorials MALG 2 serie C.

Tutorials MALG 2 serie C with corrections.

# **4 Course MOVEX2 at Telecom Nancy (past year)**

## **4.1 Slides for the course MOVEX2**

### **4.1.1 Lecture 0 Overview of the course**

Overview of the course

### **4.1.2 Lecture 1 Vérification mécanisée de contrats (III)**

Lecture 1 Vérification mécanisée de contrats (III)

### **4.1.3 Lecture 2 Théorie du point-fixe et applications**

Lecture 2 Théorie du point-fixe et ses applications

### **4.1.4 Lecture 3 Modélisation synchrone**

Lecture 3 Modélisation Synchrone

## **4.2 Tutorials**

Serie C Tutorials serie C.

Tutorials serie C with solutions.

LUSTRE Programs as solutions for serie C .

## **4.3 TP Noté SLE ENSEM lundi 19 mai 2025**

- le sujet se trouve à ce lien [tpmovex25](#).
- les fichiers utiles pour le sujet se trouvent à ce lien [files25.zip](#).

## **References**