

# Research and Teaching

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Neat Software Designs

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## **General outline:**

- Introduction
- Research interests
- Teaching
- Questions

# Introduction

20 years work experience:

- 9 years – Research
- 5 years – Teaching
- 9 years – Engineering

# Introduction

- Research:
  - Formal verification
  - Model checking
  - Control systems
  - Machine translation
- Teaching:
  - Mathematics
  - Formal methods
  - Programming languages
  - Data bases
  - Software development
- Engineering:
  - User requirements
  - Specification and docs.
  - Design and Architecture
  - Testing and development
  - Product ownership

# Introduction

## Experience with languages:

- C/C++
- UML
- C#
- Java
- SQL
- JavaScript
- Bash
- MATLAB
- Mathematica
- Python
- R

## Research interests: Earlier

### **Static program analysis:**

- Information stream quality
- Hoare-based verification of C

### **Model Checking Markov Chains:**

- Statistical model checking CTL
- Steady-state detection

### **Statistical Machine translation:**

- Distributed Machine Translation Infr.

### **Cyber physical systems:**

- Computable CTL\* model checking
- Symbolic regression for BDD controllers

## Research interests: Recent

### **Deep learning for control:**

- Neural Networks as Correct-By-Design Controllers:
  - Performance
  - Representations
  - Verifiability
- Compact control law representations.
  - Data science models?

### **Model driven engineering:**

- Runtime guarantees by verifying OCL constraints on DMs.

## Research interests: Future

### **Artificial Intelligence:**

- True artificial intelligence
  - Self-motivated
  - Unsupervised learning
- Model checking
  - Design, training, robustness?
- Static program analysis
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### **Domain specific languages:**

- Evolution of DSL meta models
  - Backwards compatibility
- Designs for DSL implementations
  - Extendible and maintainable
- Runtime guarantees via static constrains



# Teaching preferences

# Teaching approach

# Questions