

C-CoRN: The Constructive Coq Repository @ Nijmegen

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Days in Logic

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From 1.9.2004 the University of Nijmegen will be called Radboud University of Nijmegen

The Constructive Coq Repository @ Nijmegen

1. Overview of CoRN and C-CoRN
2. History
3. Features
4. Some Examples
5. Future Directions

The Constructive Coq Repository @ Nijmegen

What?

A library of constructive mathematics formalized in Coq

Where?

Repository: University of Nijmegen (NL)

Users: (some day) all over the world...

Why?

Formalize mathematics in a systematic way

Analyze the process of formalizing mathematics

History

- The FTA project [1999-2001]
 - Algebraic Hierarchy
 - Real and complex numbers, polynomials
- Real Analysis [2001-2002]
 - Partial Functions, differentiation, integration
 - Power series, transcendental functions
- C-CoRN [2002-]
 - Metric spaces, complex exponential
 - Group theory, Lagrange's Theorem
 - Models and counter-examples

Methodology

- Aim at generality
- Constructive reasoning, compatible with classical axioms
- Two-sorted logic
- Applications: algebraic reasoning, program extraction

Organization

- Internal coherence
 - structured according to subject
 - syntax conventions
- Visibility
 - documentation vs. presentation...
 - focus on mathematical and metaformalization issues

Examples

- from the library:

algebra : $\forall f:R[\mathbb{C}].(\text{nonConstant } f) \Rightarrow \exists z:\mathbb{C}.f(z) = 0$

trigonometry : $\forall x:\mathbb{R}.\cos(x)^2 + \sin(x)^2 = 1$

complex numbers : $e^{i\pi} + 1 = 0$

Examples (cont.)

- program extraction: computed values of constants

approximation	value of e	value of $\sqrt{2}$
0	$\frac{0}{1} = 0$	$\frac{0}{1} = 0$
1	$\frac{1}{1} = 1$	$\frac{3}{3} = 1$
2	$\frac{2}{1} = 2$	$\frac{3}{3} = 1$
5	$\frac{65}{24} \approx 2.70833$	$\frac{35}{27} \approx 1.2963$
10	$\frac{98641}{36288} \approx 2.71828$	$\frac{27755}{19683} \approx 1.4101$

The Future

- More users
- More topics
 - complex analysis
 - number theory
- More applications