Utrecht University

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

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Waterproof: Demo of an educational tool built on a theorem prover

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Outline

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About proof

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  - Communicating a mathematical idea or technique
- Our goal: Train (first-year mathematics) students to write mathematical proofs

Challenges

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- Long feedback loop

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- Caveat: Learning to use a proof assistant is not a learning objective

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  - Uses controlled natural language
  - Provides tuned automation
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- A frontend built on top of Visual Studio Code
  - Worksheet style editor
  - Also used by teacher to create exercises

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  - 174 last homework

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- Help.
- Placeholders
- Feedback and errors
- Chains of inequalities
- Scopes
- Forced signposting
- Symbols panel
- Tactics documentation

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Building on a proof assistant

- Solid foundation

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- $\exists x \in \mathbb{R}, x > 0 \wedge \ldots$ vs $\exists x > 0, \ldots$
- $f : \mathbb{R} \setminus \{0\} \to \mathbb{R} := x \mapsto \frac{1}{x}$

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- `Assume that x > 0 as (i).`

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- It is possible to hide the foundations of a proof assistant.
- Trying to connect theorem provers to paper proofs brings interesting challenges.

References

Aalt Jelle Wemmenhove, *Waterproof: Transforming a proof assistant into an educational tool*, Phd thesis 1 (research tu/e / graduation tu/e), Mathematics and Computer Science, March 2025, Proefschrift.

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Sharing science,
shaping tomorrow

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