My Research

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Today:

- Who am I?
- My research topic “Gröbner Bases”
- My research topic “Theorema”
- I will answer every question

Who am I ?

A PhD Student:

- 1965: Invented Gröbner Bases
- Earned my living as a "programmer"
- Enabled my living as a professor later on

Who am I ?

A Professor:

- at JKU since 1974
- for “Computer Mathematics”

Who am I ?

A Research Manager:

- 1974 / 1987: founded RISC
- 1985: founded JSC
- 1998: founded SCCH
- 1999: co-founded SFB “Comp Math”
- 2003: co-founded RICAM
- 2009: co-founded DC “Comp Math”

Who am I ?

Exercise:

An Innovation Manager:

- 1987: founded Swpark Hagenberg
- 1992: founded “FH” Hagenberg
- … negotiated with approx. 350 companies … (projects, start-ups, start branches)

The Innovation Power of Math Research

RISC

Research Topic Gröbner Bases

Problem was posed (in disguise) 1899 by P. Gordan.

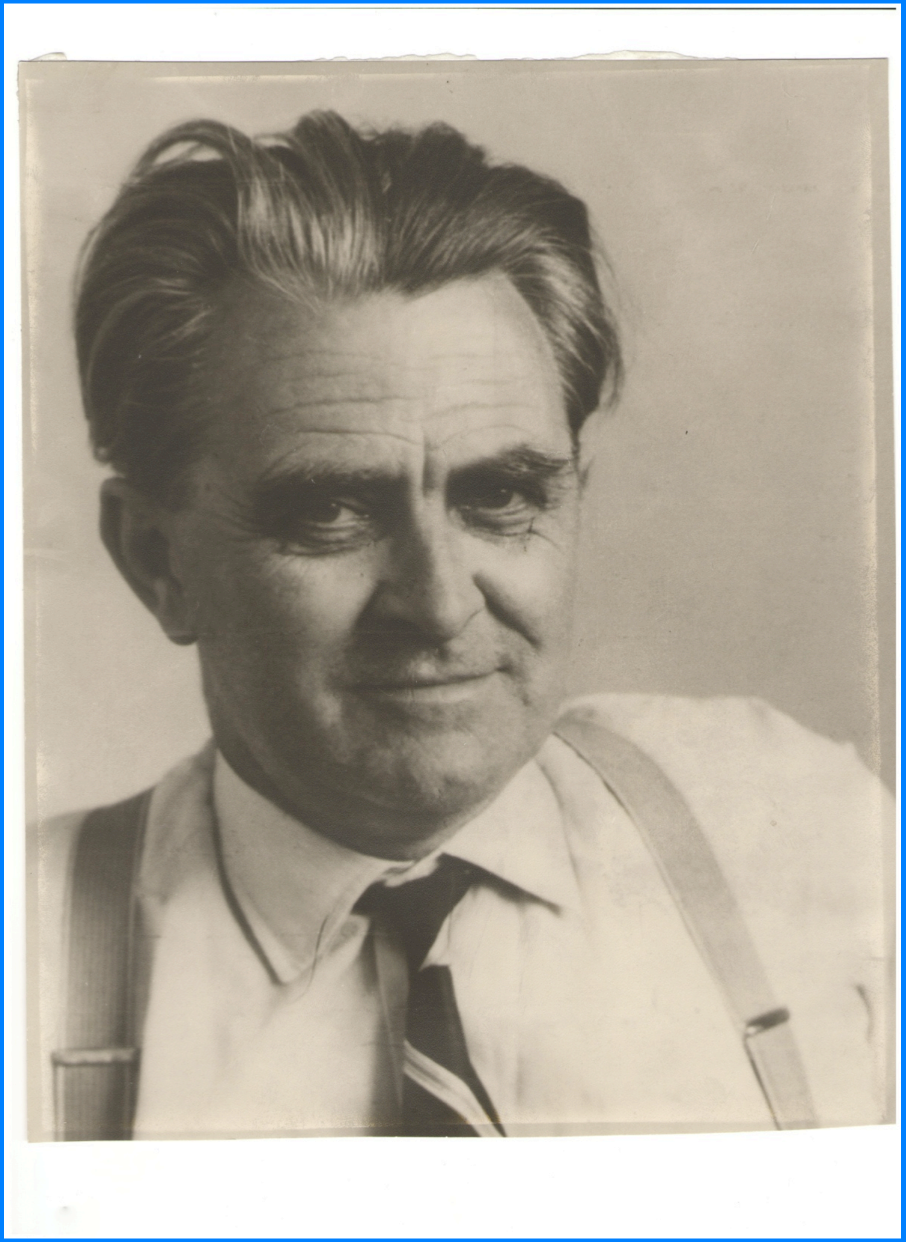
Wolfgang Gröbner posed the problem to BB 1964 at LFU Innsbruck.

BB solved the problem 1965 (PhD thesis).

By Gröbner bases, a (big) number of fundamental problems in algebraic geometry (commutative algebra, polynomial ideal theory) can be solved algorithmically.

Non-constructive existence of GB: trivial.

Construction: highly non-trivial.



Wolfgang Gröbner
1899-1980

Wolfgang Gröbner
at a conference in Innsbruck
around 1965

Location of remodeled toilette, BB's programming office.

Leopold Franzens University Innsbruck

1995
at Fujitsu Lab:
dozens of research lab
around the world

Research Topic Theorema

Meta: How can the invention, verification, and organization of math knowledge be algorithmized?

Study the process in the "toilette of math".

Current state: cum grano salis, I can now, 2013, automatically simulate my own invention process of 1965.

When I die, I will leave
my brain in a Mac … and go to Steve

Every Question will be Answered

Exercises:

- Exercise on Gröbner Bases: Give three examples of trivariate non-linear poly systems with no solution, finitely many solutions, and infinitely many solutions. Compute their Gröbner bases (use Mathematica) and argue how one can detect the number of solutions by just looking to the shape of the respective Gröbner bases.

- Exercise on Theorema: Take the inductive definition of + on the naturals given in the lecture and prove inductively

$$m + n = n + m$$

On the way to a proof detect useful lemmata (by analyzing the failing proof) and try to prove them. (On the way to a proof of the lemmata …)