Uwe Storch's Mathematical Work

Hubert Flenner

December 8, 2010

Factorial domains
- The PhD thesis: $\mathbb{Q}$-factorial domains
- The work with Bingener
- Brieskorn singularities

Differential modules
- Differential modules of (semi-)analytic algebras
- Differential dependence of ideals

Further results
- Number of equations
- The Oberseminar in Osnabrück
- (Quasi-)Frobenius Algebras

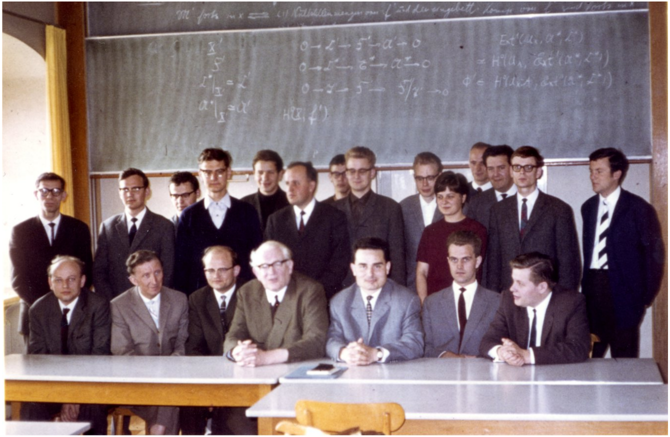
The Books

Bibliography

Biographical data

- *12.07.1940 in Leopoldshall
- 1960/66 student University Münster and Heidelberg
- 1966 PhD Münster
- 1966/67 Assistent Münster
- 1967 Assistent University Bochum
- 1972 Habilitation at Bochum
- 1974 Full Professor Osnabrück
- 1981 Full Professor Bochum
- Retired since 2006

Münster: Behnke's Oberseminar 1965



Storch
Spallek Behnke Holman Vetter Reiffen

$\mathbb{Q}$-factorial domains

Adviser G. Scheja

Definition

A Krull domain A is called $\mathbb{Q}$-factorial (or almost factorial) if $\mathrm{Cl}(A) \otimes \mathbb{Q} = 0$ or, equivalently, if every element in $\mathrm{Cl}(A)$ is torsion.

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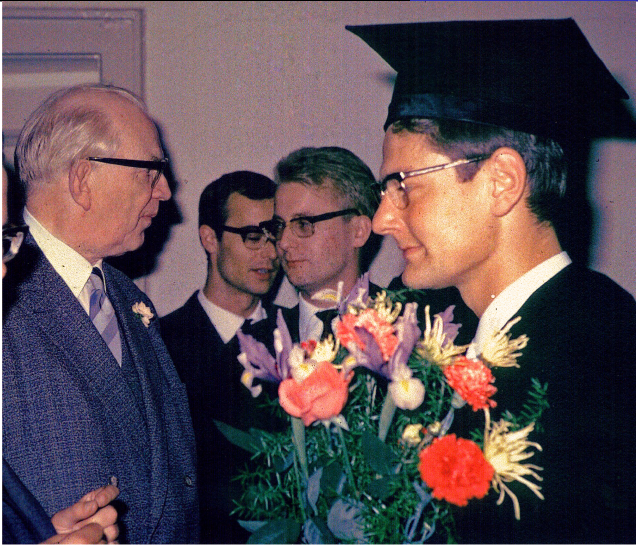
5. If $\dim A = 2$ then A is $\mathbb{Q}$-factorial iff it has a rational singularity.
6. Numerous examples, e.g. $A = \mathbb{C}\{x, y, z\}/(x^r + y^s + z^t)$ $(r, s, t$ pairwise coprime) is $\mathbb{Q}$-factorial iff $(r, s, t) = (2, 3, 5)$.



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Storch *Math. Ann. 183(1969): If A is analytic $\mathbb{C}$-algebra, $\mathrm{Cl}(A)$ is finitely generated then $\mathrm{Cl}(A) \to \mathrm{Cl}(A\{T\})$ is an isomorphism. Moreover $\mathrm{Cl}(A)$ is finitely generated iff A is 1-rational.*

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Definition (Danilov 70): A is said to have discrete divisor class groups if $\mathrm{Cl}(A) \to \mathrm{Cl}(A[[T]])$ an isomorphism.

Platte Günther Kuhn Flenner Bingener Lippa Wiebe

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The work with Bingener

Definition

An excellent $\mathbb{Q}$-algebra A is said to have s-rational singularities if for some resolution of singularities $f : X \to \mathrm{Spec} A$ we have $R^i f_*(\mathcal{O}_X) = 0$ for $i = 1, \dots, s$.

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Bingener, Jürgen; Storch, Uwe: *Zur Berechnung der Divisorenklassengruppen kompletter lokaler Ringe.* [On the computation of the divisor class groups of complete local rings] Leopoldina Symposium: Singularities (Thüringen, 1978). Nova Acta Leopoldina (N.F.) 52 (1981), no. 240, 7–63.

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4. Calculation of many examples, e.g. Brieskorn polynomials in dimension 3 but only in the case that there are no period relations.

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Let A be a quasihomogeneous isolated hypersurface singularity of dimension 3 over $\mathbb{C}$ and $E = \mathrm{Proj} A$. Main observations:

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Theorem

If $(\omega_A)_0 = 0$ *then* $\mathrm{Cl}(A) \cong \mathbb{Z}^{\varrho(E)-1}$, *where* $\varrho(E) := \mathrm{rk}\mathrm{Pic}(E) = H^2(E, \mathbb{Z})$.

Brieskorn singularities

Storch, J. Reine Angew. Math. 350 (1984), 188–202

Theorem

There is an algorithm to compute the Picard-numbers of $t_1^{r_1} + t_2^{r_2} + t_3^{r_3} + t_4^{r_4} = 0.$

Difficult case: $\frac{1}{r_1} + \ldots + \frac{1}{r_4} \geq 0.$

Scheja, Günter; Storch, Uwe: *Differentielle Eigenschaften der Lokalisierungen analytischer Algebren.* Math. Ann. 197 (1972), 137–170

Aim: Generalize the theory of differentials to much wider classes of rings

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The Zariski-Lipman conjecture for hypersurface singularities holds.

Scheja, Günter; Storch, Uwe: *Über differentielle Abhängigkeit bei Idealen analytischer Algebren.* Math. Z. 114 1970 101–112.

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If $\operatorname{char} k = 0$, $A = R/\mathfrak{a}$ *and* $R = k[[x_1, \dots, x_n]]$ *is regular then*

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Scheja, Günter; Storch, Uwe: *Fortsetzung von Derivationen.* J. Algebra 54 (1978), no. 2, 353–365

Theorem

Suppose that $f : X \to Y$ is a dominant finite morphism of algebraic varieties over $\mathbb{C}$, where X is normal. Then a vector field V on Y admits a lifting to X if and only if it is tangent to $f(C)$ for every component C of the critical set of f.

Storch, Uwe: *Bemerkung zu einem Satz von M. Kneser.* Arch. Math. (Basel) 23 (1972), 403–404

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Every algebraic set in $\mathbb{A}^n$ is set-theoretically the intersection of n hypersurfaces.

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Eisenbud, David; Evans, E. Graham, Jr.: *Every algebraic set in n-space is the intersection of n hypersurfaces.* Invent. Math. 19 (1973), 107–112

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If A is a DVR: Roquette

Application to curves

Theorem

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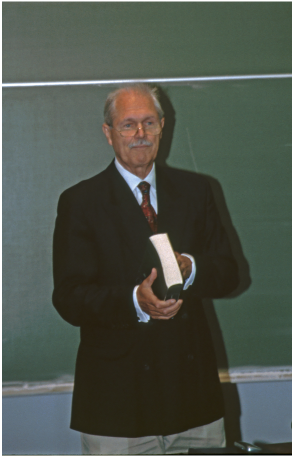
When are Dedekind's, Noether's and Kaehler's different equal (they describe all the ramification locus of $A \to B$.)

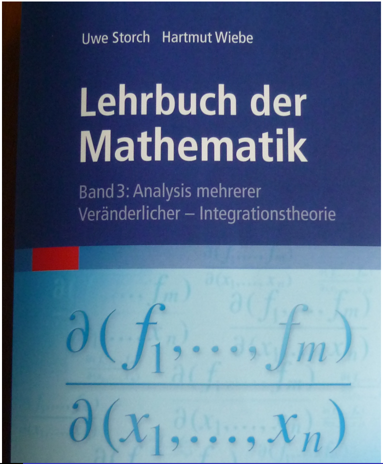
2003 Oberseminar Bochum

Textbook of Algebra

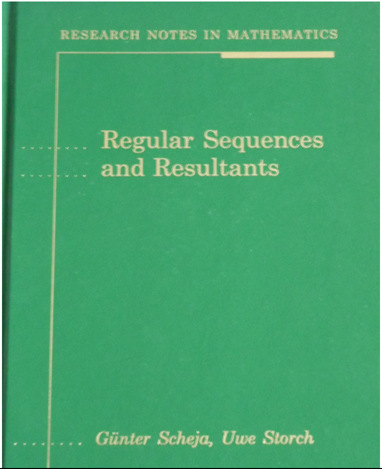


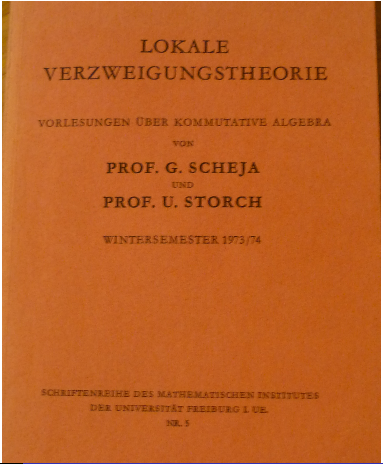
Wiebe, Scheja 2000

Textbook of Mathematics for mathematicians, physiscists, computer scientists

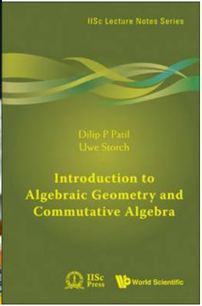


Regular sequences and resultants/Lokale Verzweigungstheorie





Introduction to algebraic geometry



- Scheja, Günter; Storch, Uwe . *Anisotropic discriminants.* Comm. Algebra 36 (2008), 3543–3558.
- Brenner, Holger; Kaid, Almar ; Storch, Uwe . *Unitarity graded field extensions.* Acta Arith. 126 (2007), 77–98.
- Patil, D. P.; Storch, U.; Stückard, J.: *A criterion for regular sequences.* Proc. Indian Acad. Sci. Math. Sci. 114 (2004), 103–106.
- Scheja, Günter; Storch, Uwe . *Regular sequences and resultants.* Research Notes in Mathematics, 8. A K Peters, Ltd., Natick, MA, 2001. x+142 pp.
- Böger, Erwin; Storch, Uwe: *A remark on Bezout's theorem.* Effective methods in algebraic and analytic geometry, 1997). Univ. Iagel. Acta Math. No. 37 (1999), 25–36.

- Scheja, Günter; Scheja, Ortwin; Storch, Uwe: *On regular sequences of binomials.* Manuscripta Math. 98 (1999), 115–132.
- Scheja, Günter; Storch, Uwe: *The divisor of the resultant.* Beiträge Algebra Geom. 37 (1996), no. 1, 149–159.
- Scheja, Günter; Storch, Uwe: *Regular sequences and elimination.* Commutative algebra (Trieste, 1992), 217–235, World Sci. Publ., River Edge, NJ, 1994.
- Scheja, Günter; Storch, Uwe: *On finite algebras projectively represented by graded complete intersections.* Math. Z. 212 (1993), no. 3, 359–374.
- Scheja, G.; Storch, U.: *On projective representations of finite algebras by graded complete intersections.* Commutative

algebra and algebraic geometry, II (Turin, 1990). Rend. Sem. Mat. Univ. Politec. Torino 49 (1991), no. 1, 1–28 (1993).

Kersken, Masumi; Storch, Uwe: *Some applications of the trace mapping for differentials.* Topics in algebra, Part 2 (Warsaw, 1988), 141–148, Banach Center Publ., 26, Part 2, PWN, Warsaw, 1990.

Scheja, Günter; Storch, Uwe: *Zur Konstruktion faktorieller graduierter Integritätsbereiche.* [On the construction of graded factorial integral domains] Arch. Math. (Basel) 42 (1984), no. 1, 45–52.

Storch, Uwe: *Die Picard-Zahlen der Singularitäten* $t_1^{r_1} + t_2^{r_2} + t_3^{r_3} + t_4^{r_4} = 0$. J. Reine Angew. Math. 350 (1984), 188–202.

Bingener, Jürgen; Storch, Uwe: *Zur Berechnung der Divisorenklassengruppen kompletter lokaler Ringe.* [On the computation of the divisor class groups of complete local rings] Leopoldina Symposium: Singularities (Thüringen, 1978). Nova Acta Leopoldina (N.F.) 52 (1981), no. 240, 7–63.

Scheja, Günter; Storch, Uwe: *Residuen bei vollständigen Durchschnitten.* Math. Nachr. 91 (1979), 157–170.

Scheja, Günter; Storch, Uwe: *Fortsetzung von Derivationen.* J. Algebra 54 (1978), no. 2, 353–365.

Platte, Erich; Storch, Uwe: *Invariante reguläre Differential-formen auf Gorenstein-Algebren.* Math. Z. 157 (1977), no. 1, 1–11.

Storch, Uwe: *Lokale Algebra und lokale Geometrie.* Jber. Deutsch. Math.-Verein. 79 (1977), no. 3, 87–135.

Scheja, Günter; Storch, Uwe: *Addendum zu: "Quasi-Frobenius-Algebren und lokal vollständige*

Durchschnitte" (Manuscripta Math. 19 (1976), no. 1, 75–104). Manuscripta Math. 20 (1977), no. 1, 99–100.

Scheja, Günter; Storch, Uwe.: *Quasi-Frobenius-Algebren und lokal vollständige Durchschnitte.* Manuscripta Math. 19 (1976), no. 1, 75–104.

Scheja, Günter; Storch, Uwe: *Über Spurfunktionen bei vollständigen Durchschnitten.* J. Reine Angew. Math. 278/279 (1975), 174–190.

Bingener, Jürgen; Storch, Uwe: *Resträume zu analytischen Mengen in Steinschen Räumen.* Math. Ann. 210 (1974), 33–53.

Storch, Uwe: *Zur Längenberechnung von Moduln.* Arch. Math. (Basel) 24 (1973), 39–43.

- Storch, Uwe: *Bemerkung zu einem Satz von M. Kneser.* Arch. Math. (Basel) 23 (1972), 403–404.
- Scheja, Günter; Storch, Uwe: *Differentielle Eigenschaften der Lokalisierungen analytischer Algebren.* Math. Ann. 197 (1972), 137–170.
- Scheja, Günter; Storch, Uwe: *Bemerkungen über die Einheitengruppen semilokaler Ringe.* Math.-Phys. Semesterber **17** (1970) 168–181.
- Scheja, Günter; Storch, Uwe: *Über differentielle Abhängigkeit bei Idealen analytischer Algebren.* Math. Z. 114 1970 101–112.
- Storch, Uwe: *Über die Divisorenklassengruppen normaler komplexanalytischer Algebren.* Math. Ann. 183 1969 93–104.
- Storch, Uwe: *Über starre analytische Algebren.* Math. Ann. 179 1968 53–62.

Storch, Uwe: *Fastfaktorielle Ringe.* Schr. Math. Inst. Univ. Münster No. 36 1967 iv+42 pp.